MEMOIRS

OF THE

NATIONAL MUSEUM OF VICTORIA

MELBOURNE

(World List abbrev. Mem. nat. Mus. Vict.)

No. 26

Issued 8th May, 1964

J. McNALLY
DIRECTOR

Published by Order of the Trustees

MELBOURNE

MEMOIRS

OF THE

NATIONAL MUSEUM OF VICTORIA

MELBOURNE

(World List abbrev. Mem. nat. Mus. Vict.)

No. 26

Issued 8th May, 1964

J. McNALLY
DIRECTOR

Published by Order of the Trustees

MELBOURNE

339/63.

NATIONAL MUSEUM OF VICTORIA

TRUSTEES

Professor E. S. Hills, Ph.D., F.R.S., D.C., D.Sc. F.A.A. (Chairman).
Henry G. A. Osborne, Esq., B.Agr.Sc. (Deputy Chairman).
Sir Arthur Stephenson, C.M.G., M.C.
Professor S. Sunderland, C.M.G., D.Sc., M.D., B.S., F.R.A.C.P., F.R.A.C.S.
James C. F. Wharton, Esq., B.Sc.
The Hon. Mr. Justice Adam, M.A., LL.M.
Sir Robert Blackwood, M.C.E., B.E.E., M.I.E. Aust.

Secretary to the Trustees:
William McCall, E.D.

STAFF

DIRECTOR
John McNally, M.Sc.

ASSISTANT DIRECTOR
A. N. Burns, M.Sc.

ADMINISTRATION

A. G. Parsons.
J. B. Goddard.
H. J. E. Clarke.

Typistes:
G. Mary Kay.
Nancie Wortley.
Joy M. Dalli.

SCIENTIFIC STAFF

Geology and Palaeontology:
Curator of Fossils: E. D. Gill, B.A., B.D., F.G.S.
Curator of Minerals: A. W. Beasley, Ph.D., M.Sc., D.I.C., F.G.S.
Assistants: H. E. Wilkinson.
M. J. Mooney.

Vertebrate Zoology:
Curator of Mammals: Vacant.
Curator of Birds: A. R. McEvey, B.A.
Assistant: A. J. Coventry.

Invertebrate Zoology:
Curator of Molluscs: J. Hope Macpherson, M.Sc.
Acting Curator of Insects: A. Neboiss, M.Sc., F.R.E.S.
Assistants: Patricia M. Hoggart.
Elizabeth M. Matheson.

Anthropology:
Curator of Anthropology: A. Massola, F.R.A.I.

Library:
Librarian: Joyce M. Shaw, B.A.

PREPARATORIAL STAFF

Preparators:

P. C. R. BOSWELL—Senior Preparator.
L. J. CHAPMAN.
M. G. TRAYNOR.
A. STEN.

HONORARY ASSOCIATES

Geology and Palaeontology:

Palaeontology: A. A. BAKER, Esq.
A. C. COLLINS, Esq.
B. TINDALE, Esq.

Mineralogy: Dr. GEORGE BAKER.

Zoology:

Ornithology: C. AUSTIN, Esq.
R. P. COOPER, Esq.
N. J. FAVALORO, Esq.
Dr. H. N. B. WETTENHALL.

Herpetology: C. TANNER, Esq.
C. W. BRAZENOR, Esq.

Conchology: J. CROFTS, Esq.
R. BURN, Esq.

Entomology: E. T. SMITH, Esq.

Arachnology: L. S. G. BUTLER, Esq.
R. A. DUNN, Esq.

Anthropology:

Anthropology: D. A. CASEY, Esq.

Photography:

Photography: BALCOMBE QUICK, Esq.

Contents.

A NEW ANT-MIMICKING MIRID BUG (HEMIPTERA–HETEROPTERA) FROM VICTORIA.

By Gordon F. Gross, Curator of Insects, South Australian Museum.

Ant mimicry is not uncommon amongst Heteroptera and occurs in several distinct families, but especially in Lygaeidae, Pyrrhocoridae and Miridae. Amongst the Miridae the bulk of the ant mimics and near ant mimics belong to the tribe Pilophorini in the subfamily Orthohylinae as now characterized by Carvalho (1952–1955).

From the Pacific area we have four genera and five species of the tribe. These are *Leucophoroptera* Poppius, 1921 (2 species), *Kirkaldiella* Poppius, 1921 and *Myrmecoridea* Poppius, 1921 from Australia, and *Anthropophagiotes* Kirkaldy, 1908 from Fiji. The only one of these which has any really close resemblance to an ant is *Myrmecoridea gracillima* Poppius.

Amongst a small consignment of Heteroptera sent recently to the author for identification were two specimens of a new genus and species of Mirid which is a very convincing ant mimic. The species belongs to the Orthotylinae as there are arolia present, free, and arising from between the claws; these are strongly convergent towards their apices. There is no pronotal collar. The ant like habitus places the species in the Pilophorini.

MYRMECOROIDES gen. nov.

Strongly myrmecomorphic genus. Eyes medium sized, not projecting. Posterior portion of head including eyes subglobular, but postclypeus (vertex), anteclypeus (frons) and labrum formed into a prominent high semicircular keel which runs longitudinally along the mid-line of the head from the level of the hind margins of the eyes above to the insertion of the rostrum anteriorly. Clypeal keel and labial keel separate structures but contiguous along an obliquely downward directed line. Antennae long and slender, first segment surpassing apex of head, second segment longest, third shorter than second but longer than first and fourth, fourth a little longer than first. Rostrum robust, reaching to about mid coxae.

Thorax small and elongate. Pronotum without a collar and divided by a strong transverse constriction behind the middle into two lobes; the anterior lobe subglobular, posterior more annuliform, inclined towards constriction and vaguely flattened above. Scutellum short, rather tumid, triangular. Hemelytra very reduced, scale or flap like, about same length as pronotum, not clearly differentiated into corium, clavus, cuneus, and membrane. Wings absent. Propleurae and pronotum one integral structure, the pronotum flowing into the propleurae smoothly in an even curve. Mesopleurae large and prominent in front of middle coxae, hind margin directed obliquely forwards and upwards. Metapleurae short, obvious only in front of hind coxae and bearing a prominent scent canal on either side which runs up to end beneath a tumid prominence.

All coxae large and longish. All legs slender and long, hind tibiae conspicuously longer than either fore or middle tibiae. Tarsi with two claws from between whose bases arise a pair of well developed arolia which are strongly convergent at their apices.

Abdomen with first two visible segments (actually II. and III.) strongly narrowed to give a petiole like appearance, then the three succeeding segments (IV., V. and VI.) become successively larger and are followed by the three apical visible segments (VII., VIII. and IX.) which gradually diminish to give a gaster like appearance. Abdomen somewhat laterally compressed so that it is higher than wide; no lateral margin; the dorsal and ventral segments running into one another, forming a depressed area in the region of the junction which may collapse inwards so as to lower the abdomen.

Genotype *MYRMECOROIDES CARINATUS* n. sp.

MYRMECOROIDES CARINATUS n. sp.

♀ Black, eyes grey. Tips of hemelytra, a median band and second antennal segment, the upper margins of true abdominal pleurites IV.–VIII., the small anal segment and the hind margin of the true ventral segment III. luteous. First antennal segment, all rostrum except tip, fore femora and tibiae, the bases and apices of the mid and hind tibiae, and the ovipositor when extended brown. All tarsi, mid femora and head more a piceous black than true black.

General appearance: Almost glabrous with some very fine sparse short white hairs, a little thicker on the edge of the keel on the head and along the tips of the hemelytra. Beneath with some hoary patches.

Length: 5·3–5·5 mms.

Locality: Holotype female, Donnybrook, Victoria, November 22, 1959, coll. J. Ozols, and two paratype females, same locality and collector, November 29, 1959; type and one paratype in the collection of the National Museum, Victoria; the other paratype, No. 120112 in the South Australian Museum, Adelaide.

A satisfactory classification of the genera within the Pilophorini sets a difficult task. In mimicking, the unwholesome insect represented is usually but a single species amongst a family group. Because of this mimicking species, though they may be closely related, must, and do, assume the likeness of quite widely separated and unlike "models". This great diversity of form and structure poses a difficult problem when their exact relationship to one another must be assessed.

Myrmecoroides can be distinguished from the other three Australian genera of Pilophorini by this key (modified from Carvalho).

1. Pronotum strong and transversely rugose; rostrum reaching apex of middle coxae . . . *Kirkaldiella Poppius.*
   Pronotum not rugose or only slightly so 2

2. Second antennal segment as thick as third, or fourth; females usually brachypterous or with modified hemielytra (short membrane) .. 3
   Second antennal segment thicker than third and fourth; females usually macropterous . *Leucophoroptera* Poppius.

3. Head with a very prominent keel above and in front . *Myrmecoroides* gen. n.
   Head without such a keel . . . . . *Myrmecoridea* Poppius.

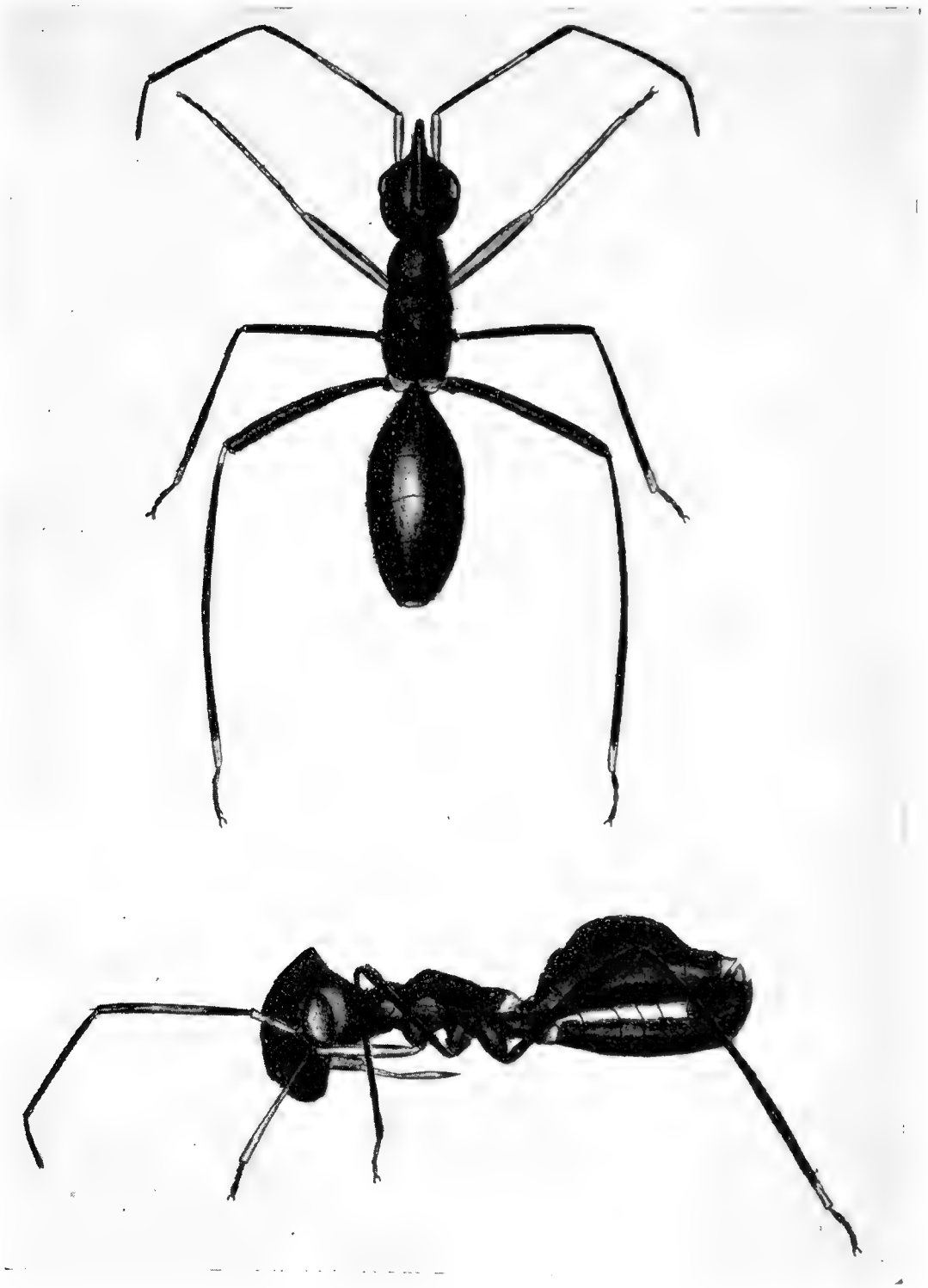
REFERENCES.

Carvalho, J. C. M., 1952.—On the Major Classification of the Miridae (Hemiptera). (With Keys to Subfamilies and Tribes and a Catalogue of the World Genera.) *Ann. Acad. bras. Sci.*, 24 (1), 31–110, pls. 1–4.

Carvalho, J. C. M., 1955.—Keys to the genera of Miridae of the World (Hemiptera). *Bol. Mus. Goeldi,* 11 (2): 5–151, pls. 1–16, (263 figs.).

Kirkaldy, G. W. 1908b.—A Catalogue of the Hemiptera of Fiji. *Proc. Linn. Soc. N.S.W.*, 33 (2): 345–81, pl. 4.

Poppius, B. and Bergroth, E., 1921.—Beiträge zur Kenntnis der Myrmecoiden Heteropteren. *Ann. hist.-nat. Mus. hung.*, 18: 31–32 (Bergroth), 32–65 (Poppius), 67–87 (Bergroth). Pls. 1–2.



Myrmecoroides carinatus new genus and species.
Top, view from above. Below, view from left hand side.

A FULGURITE FROM KARNAK, WESTERN VICTORIA.

By A. W. Beasley, Curator of Minerals, National Museum of Victoria.

ABSTRACT.

This paper records the discovery of a fulgurite approximately 5 feet long in a sandhill at Karnak, Western Victoria. It has been formed by a lightning discharge penetrating the sandhill and melting the quartz sand along its path. The fulgurite is tubular in form, and is composed essentially of lechatelierite (silica glass) and partly fused quartz grains. Its central cavity is considered to be due to rapidly-developed outward pressure from the expansion of heated gases (steam and air) along the path of the lightning discharge. Probable causes and modes of formation of various other characters of the fulgurite are discussed. New records of Victorian fulgurites are listed from Goroke, Kiata and Glenthompson.

Introduction.

In October 1959 an unusual specimen was submitted to the Museum for identification. The specimen, found at Karnak in Western Victoria, proved to be a fulgurite fragment. As few fulgurites had been recorded from Victoria, only two fragments being then in the Museum Collection, further search in the vicinity was encouraged. This search resulted in the finding of the fulgurite now described. It is similar in nature to what are called " sand-tube " fulgurites by Fenner (1949). It has been formed by the melting of quartz sand by lightning, and is tubular in form. The fulgurite is the longest so far discovered in Victoria.

Occurrence.

The fulgurite (see Plate 1) was found by Mr. H. A. Keys in a sandhill on the property of Mr. J. F. Armstrong of Karnak, 9 miles south of Goroke, Western Victoria. This is flat, semi-desert country just south of the area known as the Little Desert. The fulgurite came from allotment 18, Parish of Karnak, County of Lowan.

FIG. 1.—Map showing Victorian fulgurite localities.

Following the discovery of a small fragment lying on the surface of the sandhill, a number of similar pieces was found scattered about nearby. Several months later, at the same locality, a piece of fulgurite was seen projecting a little above the sand surface. Armstrong and Keys dug at this point and, on finding that the fulgurite extended vertically downwards, they excavated to a depth of 6 feet and extracted the entire fulgurite from the sand. It proved to be brittle and, in spite of great care, broke into segments up to 3 inches in length during the excavation and removal. Each piece was systematically kept, and the fulgurite has been mounted to exhibit its original form. Photographs (see Plate 2) were taken at various stages of excavation of the fulgurite, which occurred practically vertical in the sand.

Description.

The Karnak fulgurite has a length of just over 5 ft. 1 in. It diminishes in width vertically from a maximum diameter of 20 mm. at the top to 3 mm. at the base.

At 2 ft. 5 in. from the top, a branch emerges downward at an angle of 20 degrees with the vertical. This branch gradually diminishes in diameter from a maximum of 6 mm. at the top to 3 mm. at the base.

At a distance of 4 ft. 7½ in. from the top the fulgurite bifurcates, the length of each forked branch being 5½ inches.

The exterior of the fulgurite is very pale fawnish grey in colour and has a rough surface. There are three or four sub-parallel, discontinuous longitudinal ridges and many small protuberances (papillae and spikes) on this outer surface. It is encrusted with partly fused and adherent unfused sand grains.

The wall of the fulgurite tube averages about 1 mm. in thickness, ranging from 0·5 mm. to 2 mm. The internal opening (lumen) is lined by smoothed and glazed silica glass (lechatelierite) containing numerous gas vesicles. Some of these cavities can clearly be seen with a hand lens, and thin sections of the fulgurite show that as well as being abundant the gas vesicles are of various sizes and shapes. In colour the lechatelierite is smoky-grey or white to the naked eye, while under the microscope much of it appears brownish. The dark colour is evidently due to impurities such as iron oxides. Flow

lines are quite conspicuous in parts of the glass, and are frequently parallel to the length of the fulgurite. Passing outwards towards the exterior, partly fused sand grains become common; they are almost entirely quartz grains.

The lumen is subcircular in cross section. It is widest at the top of the fulgurite, where the maximum diameter is 7 mm., and it decreases downward to 1 mm. at the bottom. This tubular cavity was found to be almost completely filled with sand.

The specific gravity of a small piece of the fulgurite, ground to a powder which was boiled in distilled water to expel all air before drying and weighing, was found to be 2·18.

Since fulgurite fragments were found scattered around the top of the Karnak fulgurite on the surface of the sandhill, the original length was apparently greater than that stated above. At the locality the sandhills are not grassed, and the surface sand is blown about particularly during periods of dry, windy weather. The number of fragments on the surface suggests that the effects of wind erosion have caused a reduction of at least 1 foot in the length of the fulgurite.

In external shape the Karnak fulgurite closely resembles a fulgurite from Moreton Island, Queensland, described by Connah, (1947, p. 20).

Composition.

Microscopic examination has shown that the Karnak fulgurite is composed essentially of lechatelierite (silica glass) and partly fused quartz grains i.e., it is composed essentially of silica.

Chemical analyses of "sand-tube" fulgurites from different parts of the world show that they are of practically the same composition as that of the sands in which they were formed. A mechanical analysis of the sandy material surrounding the Karnak fulgurite shows that it is made up of:—

Sand size particles 92·15 per cent.

Silt size particles 6·19 per cent.

Clay size particles—1·66 per cent.

Under the microscope this surrounding sand is seen to be composed almost entirely of quartz. Other minerals, including limonite, felspar, magnetite, ilmenite, leucoxene, tourmaline, zircon, rutile and mica, are very scarce. The quartz grains are not greatly iron-stained.

A mechanical analysis of the sandy material from inside the fulgurite tube showed that it is made up of:—

Sand size particles—92·13 per cent.
Silt size particles—6·29 per cent.
Clay size particles—1·58 per cent.

The mechanical composition is thus almost identical with that of the sandy material surrounding the fulgurite. Microscopic examination has shown that the mineralogical composition also is almost identical with that of the sand surrounding the fulgurite.

Chemical analyses of " sand-tube " fulgurites (Fenner, 1949, p. 134) show a range in silica content from 88·46 per cent. to 96·44 per cent. It has generally been found that the fulgurite is more siliceous than the surrounding sand.

Formation.

Enquiry has indicated that violent electrical storms are not infrequent in the Karnak–Goroke area of the Western Wimmera and also in the adjoining Mallee district of Victoria. There are many sandhills in both of these districts.

To form the Karnak fulgurite a lightning discharge penetrated the ground to a depth of more than 5 feet, forking twice and melting the quartz sand along its path. A very high temperature must have existed, since the melting point of quartz is over 1,700 degrees Centigrade—although with some materials with fluxing effects present the quartz would melt at a lower temperature.

The internal opening (lumen) is most probably due to rapidly-developed outward pressure from the expansion of heated gases (steam and air) along the path of the discharge. Excavation work to extract the fulgurite from the sandhill showed that the sand became damp at a depth of 3 inches below the surface, and that water was present at a depth of 5 ft. 6 in. Enquiry indicates that the sand remains damp within a few inches of the surface throughout the year, although the water table falls during the summer months. The terrific heat of a lightning discharge in damp sand would produce a large amount of steam almost instantaneously, as well as melting the sand grains. Microscopic examination shows clear evidence of the flow movements that occurred in the once viscous and frothy siliceous mass. Cooling of the melted mass of silica was rapid, the outer

part solidifying first. Pressure mainly from the rapid expansion of the steam would force hot, plastic silica outward, apparently producing a tubular space up which the gas rushed to escape at the top. Since the cooling was too rapid for crystallization, the fulgurite solidified as a mass of vesicular silica glass with a tubular form.

The glazing on the surface of the lumen has apparently been caused by the rush of gas upwards through the tube.

With reference to the semi-fused and unfused sand grains, it would seem that they were embedded in the rapidly cooling mass by the external pressure of the surrounding sand.

The water table appears to have been a factor in determining the downward limit of the fulgurite; and the fulgurite's shape is no doubt partly due to differential resistance to passage of the lightning discharge, resulting from variations in moisture content, compaction, &c. of the sand.

Unequal contraction of the fulgurite glass on cooling would produce fine cracks in it. Subsequent weathering would enlarge some of these cracks and, from settling of the sand in the sandhill, there would probably be further fracturing of the thin-walled fulgurite. Some material has probably entered the central cavity through such cracks, although most of the sand inside the fulgurite tube is believed to have entered from the top. Since the fulgurite would be left open at the top on solidification, sandy material might have entered soon afterwards.

With reference to the formation of fulgurites, Simpson (1931, p. 146) has recorded that at West Popanyinning in Western Australia a violent flash of lightning was seen to strike some sandy ground and " thereafter smoke or steam was observed rising from the ground where it was struck ". He records that on quick investigation the ground was found to be blackened and still hot over an area of about 50 square inches, and digging revealed a " sand-tube " fulgurite approximately 3 feet long.

Fulgurites considerably longer than the one here described have been found in various parts of the world. The force of the lightning stroke, the thickness of sand, and the resistance to the passage of the electrical discharge in the ground are the controlling factors which determine the length of " sand-tube " fulgurites. In considering the formation of fulgurites it is significant to note that, according to Professor L. B. Loeb (1949, p. 22), a temperature of 30,000 degrees Centigrade may be reached in a lightning flash.

Victorian Fulgurite Localities.

In Victoria, fulgurite fragments have been recorded by Fenner (1949, p. 133) from Bronzewing, near Ouyen, in the Mallee district. Baker (1959, p. 217) has also recorded them from several places in the Mallee district, viz., at Yarrara, Red Cliffs, Tempy and south of Cowangie.

As well as at Karnak, fulgurites have recently been discovered at Goroke, Kiata and Glenthompson in Western Victoria. At these localities they were found mainly as small fragments lying scattered about on the surface of sandhills. However, excavation in a sandhill near Goroke resulted in the extraction of a fulgurite which persisted downwards for 3 feet. The specimens from these localities are now in the Collection of the National Museum of Victoria. They are similar in nature to the Karnak fulgurite.

ACKNOWLEDGMENTS.

Mr. H. A. Keys and Mr. J. F. Armstrong are to be commended for their enthusiasm and patience in finding and excavating the Karnak fulgurite. The writer wishes to thank them both for information and photographs. The fulgurite has been donated to the National Museum of Victoria (Reg. No. E2710), and is now on exhibition.

REFERENCES.

Anderson, A. E., 1925.—Sand Fulgurites from Nebraska. *Neb. St. Mus. Bull.* 7 (1), 49–86.

Baker, G., 1959.—Tektites. *Mem. nat. Mus. Vict.*, 23, 1–313.

Connah, T. H., 1947.—A Fulgurite from Moreton Island. *Qld. Govt. Min. J.*, 48, 20.

Fenner, C., 1949.—Sandtube Fulgurites and their bearing on the Tektite Problem. *Rec. S. Aust. Mus.*, 9, 127–142.

Loeb, L. B., 1949.—The Mechanism of Lightning. *Sci. Amer.*, 180 (2), 22–27.

Petty, J. J., 1936.—The Origin and Occurrence of Fulgurites in the Atlantic Coastal Plain. *Amer. J. Sci.*, 31, 188–201.

Simpson, E. S., 1931.—Contributions to the Mineralogy of Western Australia; Series 6. *J. roy. Soc. W. Aust.*, 17, 145–146.

PLATE 1.

The Karnak fulgurite mounted for display purposes.

Fig. 1. Commencement of fulgurite excavation at Karnak, Western Victoria.

Fig. 2. A later stage of the excavation. Note piece of fulgurite in man's hand.

PLATE 2.

HAY-SILICA GLASS FROM GNARKEET, WESTERN VICTORIA.

By George Baker, Honorary Associate in Mineralogy, and Alfred A. Baker, Honorary Associate in Palaeontology, National Museum of Victoria.

Contents.

ABSTRACT.

The burning of two adjacent haystacks in the Parish of Gnarkeet, Western Victoria produced approximately 16 tons of hay-silica glass from some 325 tons of pasture plants. The hay-silica glass resulted largely from fusion and melting of the opal phytoliths contained in silica-accumulator species of plants. The opal was fused in the presence of relatively abundant fluxes provided by K_2O, Na_2O, CaO and MgO contained in plant ash.

INTRODUCTION.

Two large stacks of baled hay, 15 feet apart on a property in the Parish of Gnarkeet, near Lismore, Western Victoria, were burnt to the ground on 7th March, 1961.

The haystacks were 4·6 miles in a direction 2° south of east, from Lismore Post Office, and were near the junction of Calvert's Road and the Hamilton Highway. The grid reference is 329.162 on the 1″ = 1 mile Military Survey Map of Lismore (1138 Lismore, 1943).

The two haystacks, only a few feet from the main highway boundary fence (Fig. 1), were constructed of 13,000 wired bales of hay totalling 325 tons in weight. The meadow hay was grown on Newer Basalt soil.

Pasture Plants in the Haystacks.

The principal constituents of the stacks were barley grass (*Hordeum maritimum*), rye grass (*Lolium perenne*), and subterranean clover, with small amounts of oaten straw (*Avena sativa*) and lesser quantities of a few other plants.

Approximate percentages of plant species in the paddock pastures cut and baled during the 1960–1961 season have been estimated by P. Lang, B.Agr.Sc., Ph.D., of Lismore, Victoria as follows:—

TABLE 1.

Approximate proportions of plant species constituting the original meadow hay, Gnarkeet.

Plant Species.	East and West Paddocks (totalling 150 Acres).	North Paddock (12 Acres cut).
	%	%
Subterranean clover	up to 30*	10
Barley grass	50	80
Rye grass	up to 20	5
Spear-thistles	few	..
Oaten straw..	nil	5
Capeweed	nil	trace

* The percentage of clover in the haystacks is likely to have been much lower due to the late date of harvesting (2nd December, 1960) and the habit clover has of wilting away at that time of the year, so that it was beneath the reach of the mower. The haystacks were roughly thatched with oaten straw.

The assemblage of plant species shown in Table 1 constitutes a highly gramineous hay of low nutritive value and high fibre content which is normally concomitant with a relatively high content of plant opal; this is borne out by the large amount of hay-silica glass left in the residues from burning of the haystacks.

Burning of the Haystacks.

Burning of the two haystacks occurred towards the end of the summer season, at 2 o'clock one morning. All combustible constituents were burnt except for small bundles of carbonized plant stalks encased in "rolls" (Plate II.) of sintery and vesicular to scoriaceous hay-silica glass (Plates II., IV.–VII.) up to 2 feet or so in size, which resulted from fusion of the opal phytoliths (plant opal) contained more particularly in species of the gramineae.

The cause of the fire was unknown; the weather conditions at the time were fine and mild, with no wind. Prior to the fire there had been a relatively prolonged, warm to hot, dry period. Between the time mowing commenced on 2nd December, 1960 and the end of stacking on 5th February, 1961, there had been only 0·13″ of rain. No lightning nor meteoritic phenomena were observed, and there had been no burning off nor naturally caused grass fires in the neighbourhood, while no other haystacks in the district were destroyed by auto-combustion.

Residues on the Burnt-out Sites.

The exposed residues on the sites of the burnt-out stacks consisted of abundant loose, fine, powdery, white to grey ash with partially buried cakes and slabs, and protruding pinnacles of hay-silica glass, relatively evenly distributed over the areas of the two adjacent sites (Plate I.). These products rested on thin layers of medium brown and blackened carbonaceous ash that were hidden from view by the overlying bed of lighter coloured ash and hay-silica glass. The soil beneath the residues was derived from Newer Basalt and was blackened in contact with the ash in many places.

Areas of Burnt-out Haystacks.

The sites of the two burnt stacks of baled hay (Plate I.) were near the fence dividing Mr. H. A. Bell's property from the south side of the Cressy–Lismore portion of the Hamilton Highway in the vicinity of Gnarkeet (Fig. 1).

The two sites differed in length and width, the smaller, more northerly of the two, nearest the highway fence, being 99 feet by 35 feet, the larger one, 15 feet away on the southern side being 127 feet by 40 feet. The longer dimensions of each site trended practically east-west. A row of twelve cypress trees (*Cupressus macrocarpa*) 30 feet high were 7 feet from the northern boundary of the smaller northern site, and another row of twelve cypress trees lined the southern boundary of the larger southern site, being 8 feet from its edge. The western edge of the longer southern site extended 28 feet further west than the smaller northern site and was 15 feet distant from a group of sugar gum trees (*Eucalyptus cladocalyx*) up to 60 feet high. The eastern ends of both sites were in line and six feet away from a group of several sugar gum trees and six cypress trees. These measurements were taken to the trunks of the trees, so that their branches were much closer to the original haystacks and could have touched or overhung them in places.

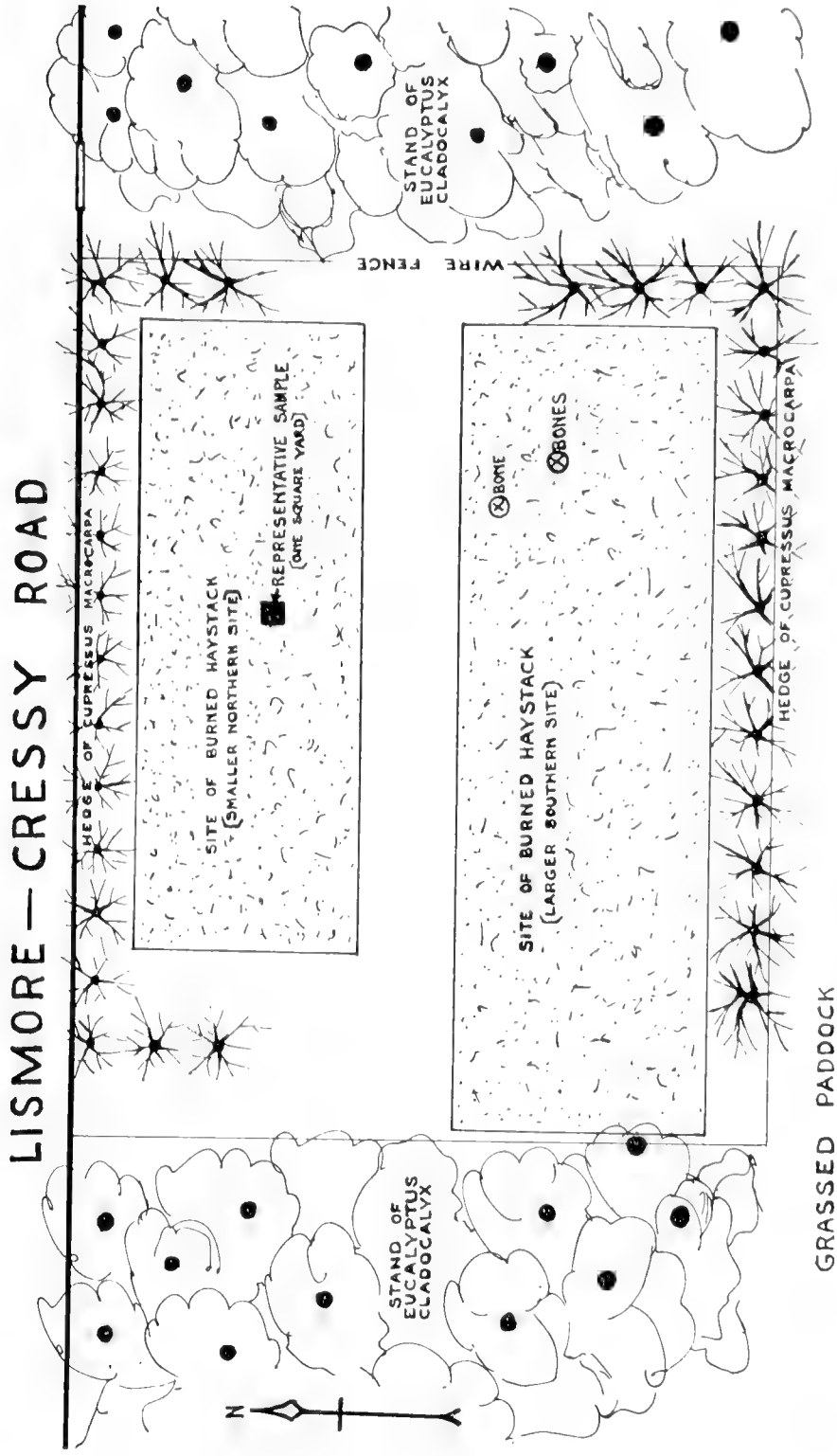


Figure 1.– Sites of burnt-out haystacks relative to surrounding trees and fences. Showing area sampled for analysis and location of calcined bones.

The fire was confined to the actual sites of the two stacks. This is evidenced by (i) the presence of unburnt grass and fence posts all around the perimeter of the sites, and (ii) the fact that the cypress and gum trees were scorched from top to bottom only on their inner sides (i.e., the sides directed towards the sites of the fire). One sugar gum tree situated a little closer to the fire (Plate I., right-hand side) and near the southwest corner of the larger southern site (Fig. 1) was burnt rather more severely than any of the other scorched trees. The bark was incinerated on the side that faced the fire and the surface of the trunk was partially carbonized. The residue of clinker at the base of the trunk of this tree was up to 4 inches thick and vesicular, but much more massive than the bulk of the generally scoriaceous to sinter-like clinker covering the rest of the burnt-out haystack sites. This particular part of the glassy residue occupied an area of some 3 to 4 feet square, and was in direct contact with the base of the tree trunk. It contained fragments of carbonized wood up to 2½ inches by 1 inch in size, these representing remnants of fallen branches that became embedded in the hay-silica glass but were not completely burnt to ash.

A few boulders of brownish-grey vesicular basalt on the sites were partially blackened, but not fused.

Thickness, General Characteristics and Amounts of the Residues.

The principal constituent of greatest interest among the residues from the fire was the hay-silica glass (Plates II. to VIII.).

The associated fine ash was not investigated in any detail because it had been too much affected by the weather at the time of investigation two months after the fire.

The Newer Basalt soil at the sites was overlain by approximately 2 inches of moist, fine, carbonaceous powder and a little blackened soil covered with a layer ⅜ inch thick of medium brown ash. Above this, an uppermost layer of from 8 inches to 12 inches in depth of white to light grey ash and sintery to clinker-like hay-silica glass formed the bulk of the residues. In this rather irregular layer, the fine ash varied from 2 inches to 6 inches in depth according to the irregularity of the layer of glassy residue on which it largely rested.

The total area covered by the residues was 8,545 square feet. An area of 3 feet by 3 feet representing the average spread and thickness of the residues was selected from near the centre of the smaller northern site (see Fig. 1). This was sampled of all

its hay-silica glass content for weighing and calculation of the approximate quantity of glass produced by incineration of the two haystacks, assuming that little or none on the sites resulted from the scorching of nearby trees. The glass thus obtained ranged from micro-beads (see attached beads in Plate IV.) of 1 mm. average size to lumps, cakes and " rolls " (Plates II. and III.) up to 2 feet long by 1 ft. 6 in. wide and 1 to 2 inches thick.

The weight of the hay-silica glass residue recovered from this area of 9 square feet (and about 1 foot deep) was 37¼ lb. General inspection revealed a relatively even distribution of glass over the combined areas (8,545 square feet) of the two sites, and it has been estimated that the 325 tons of meadow hay constituting the two stacks yielded 15·8 tons of hay-silica glass. This is equivalent to nearly 4·9 per cent. of the original material forming the stacks.

It was impracticable to determine the quantities of the fine, powdery ash types produced by the fire, because the sites were not sampled until eight weeks after the burning of the haystacks. During this period, wind and a little rain had removed some of the lighter ash components; the glassy residue, however, was evidently unaffected to any noticeable degree by the effects of the weather.

*The Hay-Silica Glass.**

Size and shapes.

The hay-silica glass was formed into various shapes (Plates II. to VIII.). Small micro-beads averaging 1 mm. in diameter occurred both as free entities in the fine powdery ash, and attached to larger pieces of the glass (Plate IV.). Broken pieces of these are very much like the so-called volcanic shards recorded from soils. Several spats, fingers and gobbets ranged in size from under half an inch across to forms three or four inches long, half to one inch wide, and half an inch thick.

Larger cakes, lumps, slabs and " rolls " (Plate II.) showed varying vesicular (Plate VII.A), scoriaceous, ropy, pinnacle, " stalagmitic " and irregular " drip " structures (Plates IV. to VII.). These types ranged in size from a few inches to two or three feet long. Some smaller fragments under ½ inch across and some of the micro-beads of the hay-silica glass were so highly charged with minute bubbles as to be pumiceous and they readily floated in water.

* The specimens of hay-silica glass described herein, and the bulk of the materials constituting the representative sample taken for study from the smaller northern site of the burnt-out haystacks, are all registered together as No. E.2741 in the collections of the National Museum of Victoria.

Alien substances.

The iron wire used in binding the bales of hay was still present, partly embedded in, partly protruding from some of the pieces of hay-silica glass, and sometimes partially rusted. Some of the iron wire had been fused, some acted as the site for accumulation of glass blebs (Plate VIII.) which ran as molten beads down upwardly directed pieces of the wire, and collected into botryoidal and other masses $\frac{1}{2}$ inch to 2 or 3 inches across (Plates VII.B, VIII.).

In one part of the larger southern site, near its eastern end (see Fig. 1), a few calcined animal bones were located amid the residues from the fire (Plate IX.). Some of these bones were incorporated in the powdery ash, some were partially embedded in the hay-silica glass.

Occasional clots of friable soil up to 2 or 3 inches across, with dark brown crusts and lighter brown cores were embedded in parts of the hay-silica glass and the powdery ash. These, however, have evidently contributed little to the composition of the adjacent glass; none were noted in the area of glass sampled for chemical analysis.

The presence of partially fused iron wire and calcined animal bones no doubt means some local contamination of the hay-silica glass. Contamination by iron in close proximity to partly fused iron wire is made evident by reddish, greenish-yellow, and pale bluish-green colourations in localized areas of the glass.

Composition.

The greater part of the glass was formed from the melting and fusion of the numerous, colourless, minute opal phytoliths contained in the barley grass, rye grass and oats (cf. Baker, 1960a; 1960b; 1961) in the presence of fluxes (CaO, MgO, K_2O and Na_2O) contained in plant ash. It is light to dark grey in colour, becoming black in a few places where significant amounts of carbonized plant material are enclosed in the glass.

A chemical analysis (Table 1), reveals that the hay-silica glass is rich in alkalis and alkaline earths which make up approximately 29 per cent. of the constituents present. Silica is the most abundant constituent and there are significant amounts of phosphorus pentoxide and manganese.

The sample analyzed was made as representative as possible. It was selected from the total quantity of glass collected and weighed (37¼ lb.) from the centre of the smaller northern site. Several pieces of the glass taken at random from this field sample were broken up into smaller pieces, quartered, crushed to a

powder and again quartered until the requisite quantity was obtained for chemical analysis. The sample so selected showed no obvious nor undue amount of contamination by metals from the iron wire, and was remote from the calcined bones found on the larger southern site.

Other plant-silica glasses, including hay-silica glass, straw-silica glass, grain-silica glass and wood-silica glass are listed in Table 2 for comparison. These are impure silica glasses produced from the burning of vegetation grown on different soils in different localities, where similar species may therefore secrete different quantities of opaline silica.

TABLE 2.

Chemical analyses of impure silica glasses formed from the natural incineration of silica-accumulator plants.

	1. %	2. %	3. %	4. %	5. %	6. %	7. %	8. %	9. %
SiO_2 ..	61·7	58·7	53·1	66·04	57·40	70·11	61·4	81·03	59·3
Al_2O_3 ..	1·16	1·31	1·17	1·55	1·81	0·48	..	2·99	1·3
Fe_2O_3 ..	0·83	0·26	0·37	0·59	0·59	0·72	5·8	0·58	0·3
FeO ..	0·28	0·03	0·03	..	..	..	..	0·78	
CaO ..	6·77	9·42	10·93	6·00	8·56	4·94	10·3	8·21	8·2
MgO ..	4·88	4·59	5·50	3·80	5·56	3·36	2·9	1·15	4·8
K_2O ..	8·53	12·83	13·00	11·98	13·58	8·76	10·1	2·07	12·0
Na_2O ..	8·73	4·77	7·27	6·88	8·98	7·97	2·4	2·34	7·2
TiO_2 ..	0·19	0·02	0·02	..	..	0·04	..	0·34	0·1
MnO ..	0·30	0·18	0·24	..	..	0·11	..	trace	0·2
H_2O (+) ..	0·20	0·08	0·57	..	..	0·02	..	0·24	0·2
H_2O (−) ..	0·12	0·02	0·02	..	..	..	..		
P_2O_5 ..	5·66	7·21	6·67	..	..	1·03	7·2	0·24	6·4
C ..	0·25	0·20	0·30	2·69	3·16	1·88	..	..	0·2
CO_2 ..	none	none	none	..	..	..	..	..	none
SO_3 ..	trace	trace	0·21	..	..	..	..	none	trace
Cl_2 ..	0·08	0·03	0·22	..	..	..	..	trace	0·1
Li_2O ..	none	none	none	..	..	..	..	..	..
Total ..	99·68	99·65	99·62	99·53	99·64	99·42	100·1	99·97	100·3
O	0·02	0·01	0·05	..	..	..	..	..	..
	99·66	99·64	99·57	..	..	..	..	..	..

KEY:

1—Hay-silica glass, Gnarkeet, near Lismore, Western Victoria. Anal. P. J. Sinnott.

2—Hay-silica glass (sample "A"), Dookie Agricultural College, near Shepparton, North-Central Victoria. Anal. P. J. Sinnott.

3—Hay-silica glass (sample "B"), Dookie Agricultural College, near Shepparton, North-Central Victoria. Anal. P. J. Sinnott.

4—Straw-silica glass, O. B. Flat, South Australia. Anal. F. L. Dalwood (see Fenner, 1940).

5—Straw-silica glass, Compton Downs, South Australia. Anal. F. L. Dalwood (see Fenner, 1940).

6—Straw-silica glass, Ramona, California, U.S.A. Anal. N. Davidson (see Milton and Davidson, 1946).

7—Grain-silica glass ("pierres de foudre") resulting from the natural electrical fusion of grain ash (see Velain, 1878).

8—Wood-silica glass, formed from charcoal (boxwood) in the suction gas plant, Stawell, Victoria. Anal. F. F. Field (see Baker and Gaskin, 1946).

9—Generalized average of Australian hay- and straw-silica glasses Nos. 1 to 5.

Although sampling of the Gnarkeet hay-silica glass was so designed as to obtain a representative general sample for chemical analysis (Table 2, column 1), there are obvious macroscopic and microscopic variations from place to place in the glass. This is evident from (i) hand specimen inspection under a x10 pocket lens, (ii) from thin section examination under the higher powers of the petrological microscope, and (iii) from differences in refractive index determinations conducted on the glass from different parts of the burnt-out haystack sites.

Apart from visual colour differences in proximity to iron wire enwrapped by the glass, other parts are whiter due to the incorporation, and or adherence, of non-volatilized fluxing materials from the plant ash. Thin sections reveal that many crystals of these substances are birefringent under crossed nicols of the petrological microscope, and that there has been variation in the degree of miscibility between them and the constituents of the melt from place to place; it is impracticable to determine how much of the salts of alkalis and alkaline earths, for example, are mechanically entrapped and how much has been absorbed and lies occult in the definitely glassy areas.

Thin sections also reveal variations in carbon content from place to place. Some pieces of the glass contain little or no carbon, others reveal several micro-fragments of carbonized plant remnants enclosed in the glass. On a macro-scale, included carbonized plant fragments are up to 2 or 3 inches across. (Plate VIII.)

Refractive index variations indicate a range in silica content in different specimens selected from various positions among the residues on the burnt-out sites, and sometimes within the compass of one and the same small fragment of the glass.

Some conception of the order of chemical variations within the hay-silica glass from one and the same burnt-out haystack site, is provided by comparison of columns 2 and 3 in Table 2. Here, specimens from different but not widely separated portions of the glass collected from the site of a burnt-out haystack at Dookie Agricultural College, near Shepparton, reveal differences of 5·6 per cent. in the silica content. The sample with less silica contains 2·5 per cent. more Na_2O, 1·5 per cent. more CaO and 1 per cent. more MgO. It also shows a little more K_2O and MnO, but rather less P_2O_5. Such variations are only to be expected across the site of a burnt-out haystack, in which the glass has been formed by non-controlled conditions under circumstances where—

(*a*) different species of plants of different composition become incinerated;

(*b*) the proportions of each species are unlikely to be precisely the same at all locations on the site;

(*c*) the plants present carry different proportions of opal phytoliths and other mineral matter;

(*d*) differential loss of more volatile constituents can arise from place to place;

(*e*) incomplete ignition of some of the plant matter results as a consequence of mechanical entrapment in the carbonized state;

(*f*) complete miscibility in all proportions does not everywhere occur, because of several factors preventing this—such as (i) differing composition of the plant ash which becomes incorporated in already molten glass, and (ii) greater or lesser opportunity to become mixed according to the length of time the plant ash was in contact with or incorporated in the molten glass;

(*g*) different quantities of alien matter became entrapped in different parts of the glass—e.g., such materials as the iron baling wire, small clots of soil, individual adventitious mineral particles from dust mechanically entrained with the hay, occasional animal bones, bird droppings, small pieces of rock fractured by heat from boulders used to anchor down thatching materials or tarpaulin covers and so on;

(*h*) variable refractoriness of substances entrapped in the glass.

Under such variable conditions as this, and because the precise compositions of the several types of plant species added to the haystack are unknown, added to the fact that it is impracticable to effect a mechanical separation of birefringent silicates, non- and partially fused opal phytoliths, and actual glass from one another for separate chemical analyses, it becomes difficult to assess—

(*a*) the quantity of birefringent silicates present;

(*b*) the quantity of actual glass present;

(*c*) the quantity of unfused more refractory substances;

(*d*) the amount of incorporated, incompletely volatilized plant substances remaining;

(*e*) the proportion of alkalis and alkaline earths that lie occult in the glass relative to their proportions occurring as mechanically entrapped non-melted, plant ash.

Hence it has not been practicable to assess the likely quantities of K_2O, Na_2O, CaO, MgO and P_2O_5, that were lost by volatilization under the circumstances of natural, non-controlled burning of haystacks in the field.

It is concluded that these impure silica glasses, arising from the burning of the pasture plants in haystacks, are generally rich in silica, alkalis and alkaline earths, poor in iron, alumina and water, and that they contain significant quantities of P_2O_5 and MnO. These features serve to distinguish them from other types of naturally occurring glasses (cf. Baker and Gaskin, 1946), and there is little doubt that their content of 50 to 60 per cent. and over of silica arises almost entirely from fusion of the opal phytoliths precipitated in silica-accumulator plants.

Refractive index, specific gravity and hardness.

The refractive index was determined by the Immersion Method, using sodium light.

One fragment of the Gnarkeet hay-silica glass gave $n_{Na} = 1{\cdot}520 \pm 0{\cdot}001$, but parts of the same fragment were a little above this value, other parts just below. This was evidently due to incomplete mixing of constituents, for the fragment revealed a partially fused boat-shaped opal phytolith with n_{Na} less than that of both the hay-silica glass and the immersion liquid. In the same refractive index liquid mount containing several fragments crushed from the hay-silica glass were a few freed

opal phytoliths, one of which was a serrated rod, one a part of a sharp-pointed opalized plant hair, and one a thin plate of opal with traces of the cell wall structure from the epidermal portion of a gramineous plant fragment. These indicate that all parts of the burning haystacks were not subjected to precisely the same conditions, otherwise these phytoliths should also have fused and melted into the glass.

One crushed micro-bead 2 mm. in diameter gave $n_{Na} = 1{\cdot}510 \pm 0{\cdot}001$, with some of the glass slightly above and some a little below this value; no opal phytoliths or incorporated plant ash constituents were detected as separate entities among the fragments from this micro-bead of hay-silica glass.

Fragments of the glass tested from several vesicular and scoriaceous pieces gave an average n_{Na} of just under 1·510.

The specific gravity of the glass determined in the powdered state in distilled water at T = 21° C. was 2·53. Its hardness on Mohs' Scale of Hardness was determined as between 6·5 and 7.

The lustre of the glass is generally vitreous, varying in places to sub-vitreous.

Micro-structures.

Several pieces of the hay-silica glass were suited to rock sectioning techniques. Thin sections revealed isotropic, vesiculated, impure silica glass (Plate X.) containing birefringent small laths, granules and bunches of minute blade-like crystals of silicates of the alkalis and alkaline earths.

Occasional clusters averaging 0·3 mm. across of birefringent needles and/or sometimes ghost-like skeletal growths and more granular crystals, were commonly situated in the glass bordering some of the larger vesicles. The needles were approximately 0·08 mm. by 0·02 mm. in size. They extinguished at angles of up to 45 degrees under crossed nicols, showed low grey and yellow polarization colours of the first order, and had a higher refractive index than that of the glass in which they were embedded. Clusters of these crystals are shown in Plate X. Elsewhere occurred occasional wisps of carbonized plant remnants and a few partially fused and non-fused opal phytoliths.

The glass forming the walls of the larger vesicles 1 to 10 mm. across often revealed riddling with minute bubble cavities 0·01 mm. to 0·05 mm. in diameter.

The remnants of incompletely fused opal phytoliths were scattered sporadically through the glassy matrix. A few retained the forms possessed originally—more particularly smooth, rod-like types.

Particles of more highly refractory, birefringent mineral species little affected by the fire were uncommon and consisted principally of detrital quartz grains. They were evidently derived particles from the various adventitious substances mechanically entrained in the hay during mowing, raking, binding and stacking.

Parts of the glass were streaky in appearance (Plate X.A), largely from the presence of strung-out, minute particles of carbonaceous matter; such areas were a faint smoky grey-brown in colour compared with surrounding translucent more or less colourless glass.

CONCLUSIONS.

Glass can be generated from the burning of grass, but there are many variants in the circumstances of transition under field conditions. The ultimate composition of the glass will vary according to (i) the species composition of a haystack, (ii) the opal phytolith-flux substances relationships from place to place in one and the same or in different haystacks, and (iii) the opportunities for physical incorporation of non-fused fluxing substances in the silica glass formed by melting of the opal phytoliths. The opal phytolith content of the meadow hay as a whole depends not only upon the availability of silica to the plants from the soil on which they were grown, but also upon the silica-accumulator potentials of the different plant species. Plants grown on the same soil do not all secrete precisely the same quantities of silica in the form of opal phytoliths, neither do the same species of plants grown on different soils in widely separated regions.

Estimates of the amounts of impure silica glass residues formed from the burning of large quantities of stacked meadow hay containing a preponderance of high-silica-accumulator plants (e.g., barley grass) in the Gnarkeet district, show that approximately 5 per cent. of glass containing upwards of 62 per cent. of silica can result from the hay. A further, unassessed, amount of mineral matter remains in the unmelted condition as loose ash (not investigated in detail herein).

Although significant quantities of alkalis and alkaline earths contained in the original hay have been lost to the glass by (*a*) remaining in the non-fused ash, and (*b*) by volatilization,

the residual glass is nevertheless rich in such components as K_2O, Na_2O, MgO and CaO, as well as in P_2O_5 and MnO. Little, if any, of these constituents were introduced from more refractory adventitious mineral matter mechanically entrained as dust particles in the original hay, or added from the soil on the sites of the haystacks.

The geological significance of this glass lies in the fact that older pieces of impure silica glass from previously burnt vegetation sometimes become buried for many years, and on exhumation by ploughing operations or by soil deflation, have been occasionally mistaken for (i) acid, vesicular, volcanic glass, (ii) fulgurites (" lightning tubes ") and (iii) glassy meteorites (tektites). Their chemical composition serves to discriminate them from volcanic glass, while their form and chemical composition distinguish them from both the fulgurites and the glass bodies (tektites) that fell upon the earth in pre-historic times from an extraterrestrial source. (cf. Baker, 1957.).

One aspect of the significance of pieces of hay-silica glass as soil constituents, is that many of the so-called volcanic shards recorded in soils, are often of microscopic dimensions and hence may have been mistakenly identified. The source of these micro-shards need not necessarily be volcanic in entirety; the small pieces of glass recorded as volcanic shards resemble small fragments from the micro-beads of impure silica glass produced by the fusion of the opal phytoliths and fluxing substances contained in gramineous and other plant species. The distribution of micro-shards in various soils is more consistent with an origin from opal-phytolith fusion during scrub and grass fires, than with origin as micro-ejectamenta from volcanic vents. The further possibility is not overlooked, however, that a few micro-shardlike bodies might have resulted from the fusion of opal phytoliths by natural electrical discharges, especially as it has now been shown by one of us that opal phytoliths are ubiquitous in atmospheric dust.

The significance of the hay-silica glass from the meadow hay aspect is that the quantity of glass formed indicates that the opal phytolith content of plant feed for herbivorous animals can be undesirably increased by man through delaying mowing and stacking. Had the meadow pastures been mown three or four weeks earlier, the content of predominant, high silica-accumulating plant species would have been diluted by more abundant, more nutritious, less opal-bearing medicks and trefoils that had wilted

down to such an extent, at the time of mowing, that they were below the reach of the mower.

The results of the various findings set out in this paper make it apparent that the quantity of impure silica glass produced from the burning of any one haystack, is likely to vary from locality to locality, and from time to time, according to the availability of silica from the particular soils on which the pasture plants were grown.

The meadow hay in the Gnarkeet area yielded 15·8 tons of hay-silica glass on burning of the haystacks. This glass was from vegetation grown on 162 acres of newer basalt soil, so that at least one ton of mineral matter that ultimately went to form the glass, was abstracted from each 10¼ acres of this type of soil which is situated in a climatically temperate region. Since the hay-silica glass contains nearly 62 per cent. of silica (SiO_2) by analysis, there has been approximately 135½ lb. per acre of silica abstracted from the Newer Basalt soils during the 1960 pasture growth season. This figure may be rather low in view of the fact that abundant fine, non-fused ash remained on the sites of the haystack fires, and this ash contained some unfused phytoliths as seen under the petrological microscope.

ACKNOWLEDGMENTS.

We are grateful to P. Lang, Esq., B.Agr.Sci., Ph.D., of Lismore for information relative to the species of pasture plants grown in the paddocks that were mown to provide the constituents of the burnt haystacks. We also thank Mr. H. A. Bell of Gnarkeet for granting access to the burnt-out sites and for permission to sample the residues.

REFERENCES.

Baker, G., 1957.—Alleged meteorite from Horsham, Victoria. *Mem. nat. Mus. Vict.*, 21: 72–78.

Baker, G., 1960a.—Phytoliths in some Australian dusts. *Proc. roy. Soc. Vic.*, 72 (1): 21–40.

Baker, G., 1960b.—Hook-shaped opal phytoliths in the epidermal cells of oats. *Aust. Journ Bot.*, 8: 69–74.

Baker, G., 1961.—Opal phytoliths and adventitious mineral particles in wheat dust. *Minergr. Tech. Pap.*, No. 4: 1–12.

Baker, G. and Gaskin, A. J., 1946.—Natural glass from Macedon, Victoria, and its relationship to other natural glasses. *Journ. Geol.*, 54: 88–104.

Fenner, C., 1940.—Australites Part IV. The John Kennett Collection. *Trans. roy. Soc. Sth. Aust.*, 64 (2): 305–324.

Milton, C., and Davidson, N., 1946.—Note on straw-silica glass from California. *Amer. Min.*, 31: 495–498.

Velain, C., 1878.—*Bull. franc. soc. mineral.*, 1: 113.

Plate I.—General view of residues from burnt-out haystacks, near Gnarkeet, Lismore district, Western Victoria. Showing fringing sugar gum and cypress trees scorched on the sides facing the scene of the fire.

Plate II. (× 0·4). Close up view of sintery and scoriaceous to ropy "roll" of hay-silica glass encasing mass of carbonized plant fragments (in front of white paper placed at rear of specimen), and protruding above the level of the general crust of hay-silica glass (at point of pencil). Note two blowholes through carbonaceous residue, some of which has been subsequently removed by wind and rainwater.

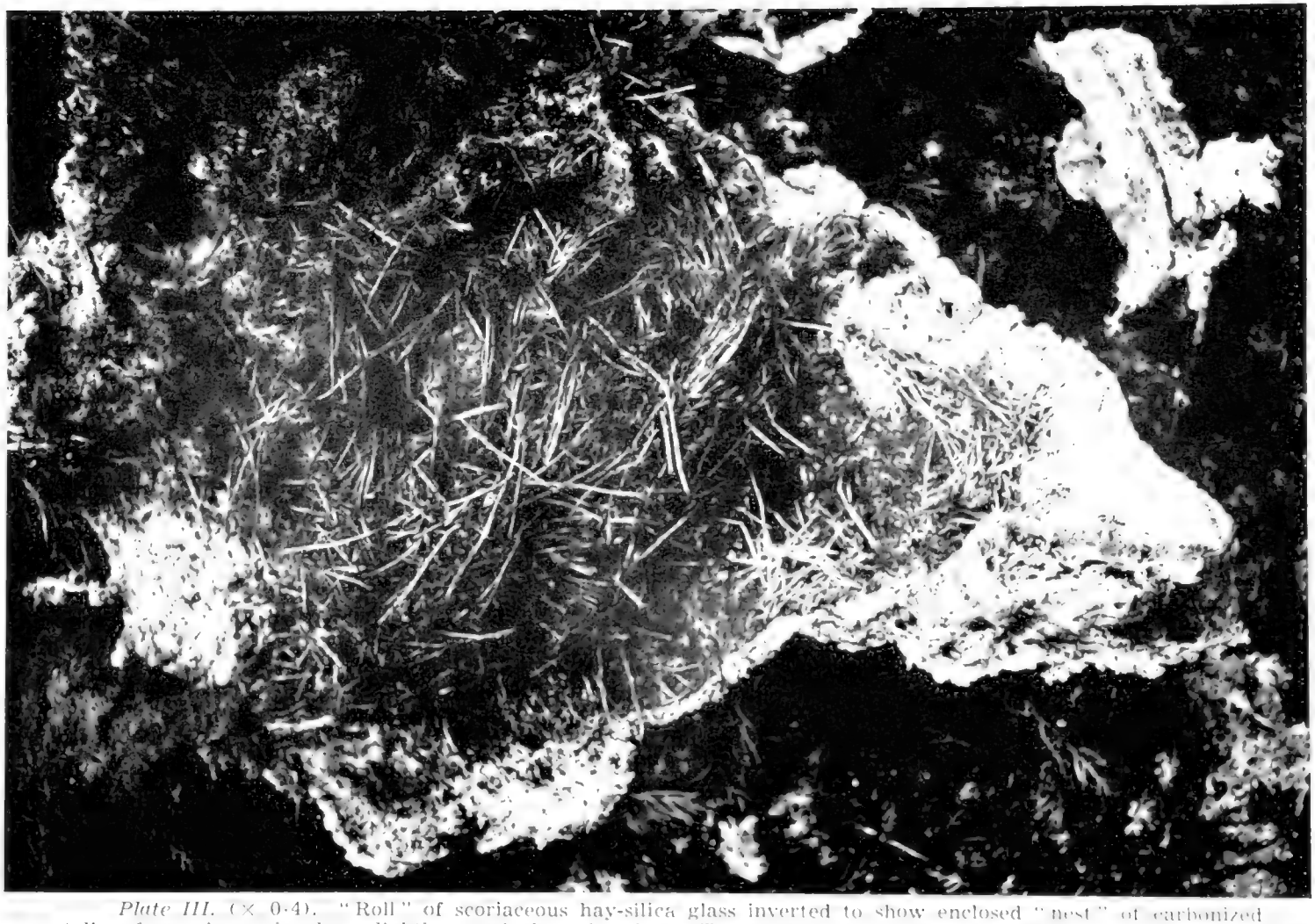


Plate III. (× 0·4). "Roll" of scoriaceous hay-silica glass inverted to show enclosed "nest" of carbonized stalks of gramineae, in places lightly attached to the glass. The apparent white colour of some carbonized grass stalks is due to the reflection of light from the surface of highly lustrous carbon containing fused opal.

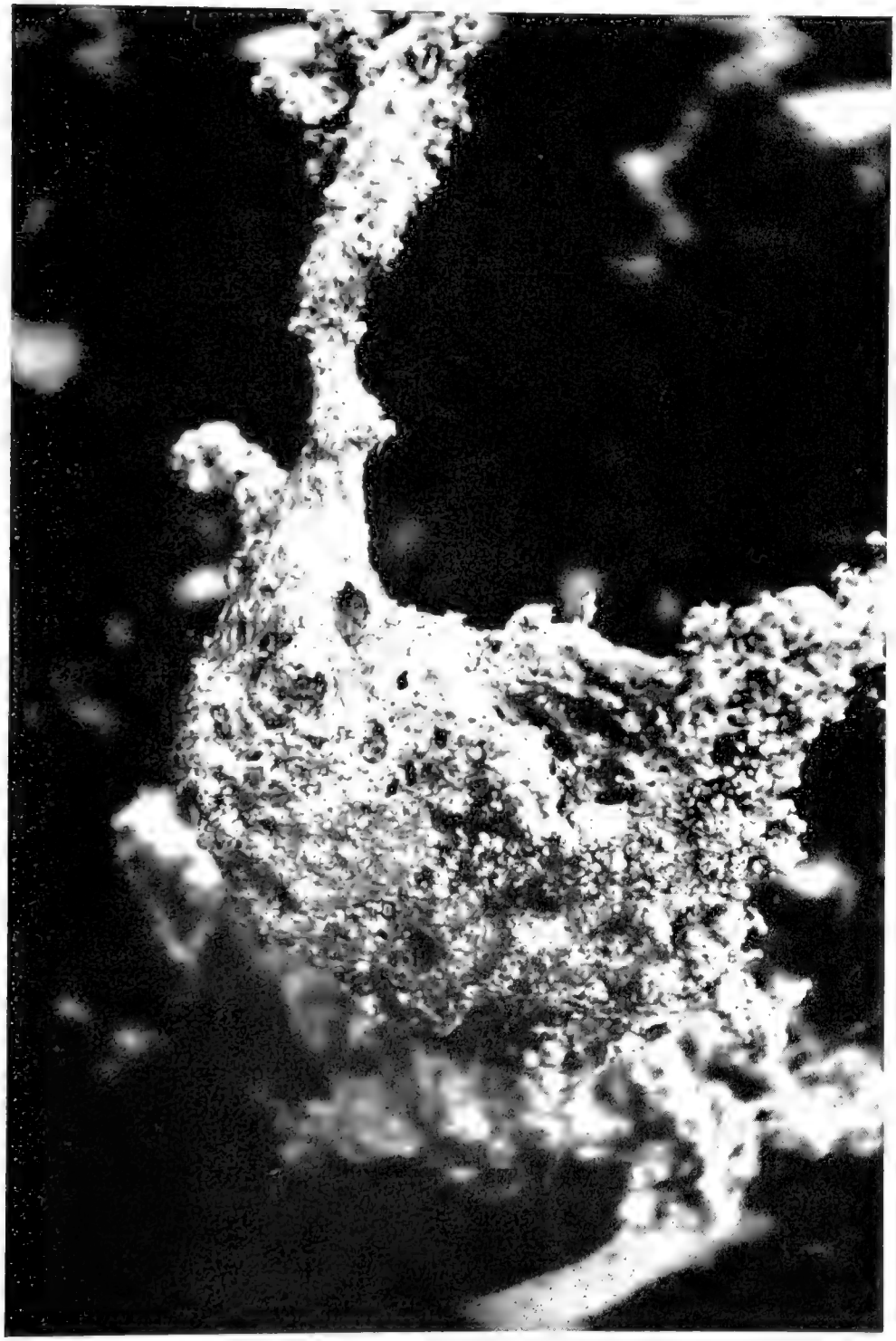


Plate IV. (× 0·5).—Pinnacle of hay-silica glass showing gas vesicles and several attached micro-beads of the glass. Specimen *in situ* on the larger southern burnt-out site.

Plate V. (×0·5).—Partially collapsed pinnacle of hay-silica glass protruding above general level of the residues from the haystack fire. Note occasional micro-beads, vesicles, and scoriaceous to ropy structures. Specimen *in situ* on the smaller northern burnt-out site.

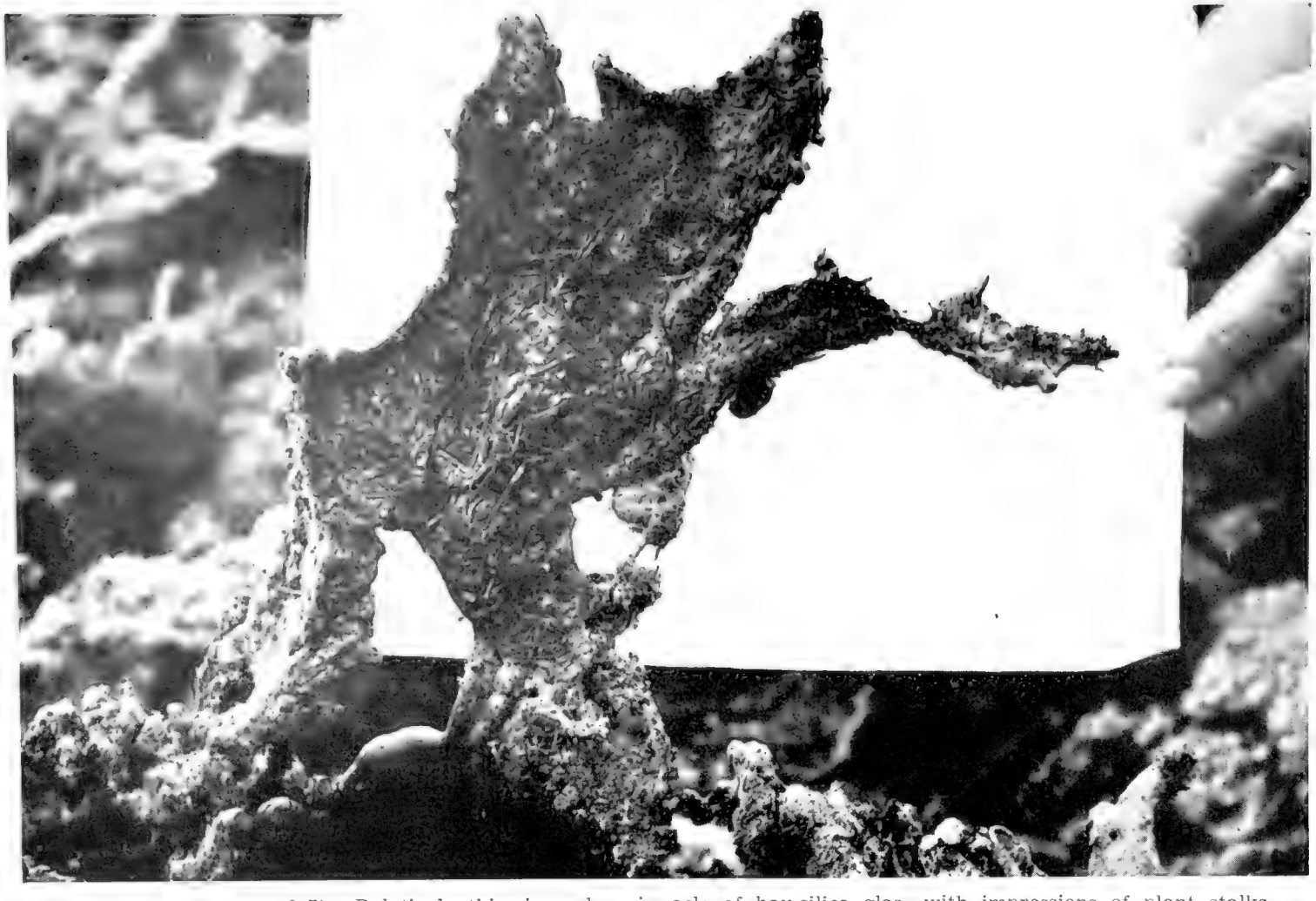


Plate VI. (× 0·5).—Relatively thin, irregular pinnacle of hay-silica glass with impressions of plant stalks (at left) and numerous, lightly attached remnants of carbonized gramineae stalks. Some minor protuberances are sharp and rough, others are rounded and smoother. Specimen *in situ* on larger southern burnt-out site.

Plate VII.—A. Section through lump of hay-silica glass showing highly vesicular character. Specimen orientated in position as found on the larger southern burnt-out site (approximately natural size).

B. Sintery to ropy hay-silica glass accumulated around remnants of iron wire used in baling the hay. (× 0·7).

Plate VIII. (× 0·9).—Hay-silica glass from base of sugar gum tree near southwest corner of larger southern burnt-out site. Showing embedded fragment of charcoal (bottom left) and protruding remnants of iron wire with occasional blebs of attached hay-silica glass.

Plate IX. (× 0·5).—Calcined animal bones (white) *in situ* amid residues from larger southern burnt-out haystack. Some of the bones lie in carbonaceous ash, some are embedded in hay-silica glass.

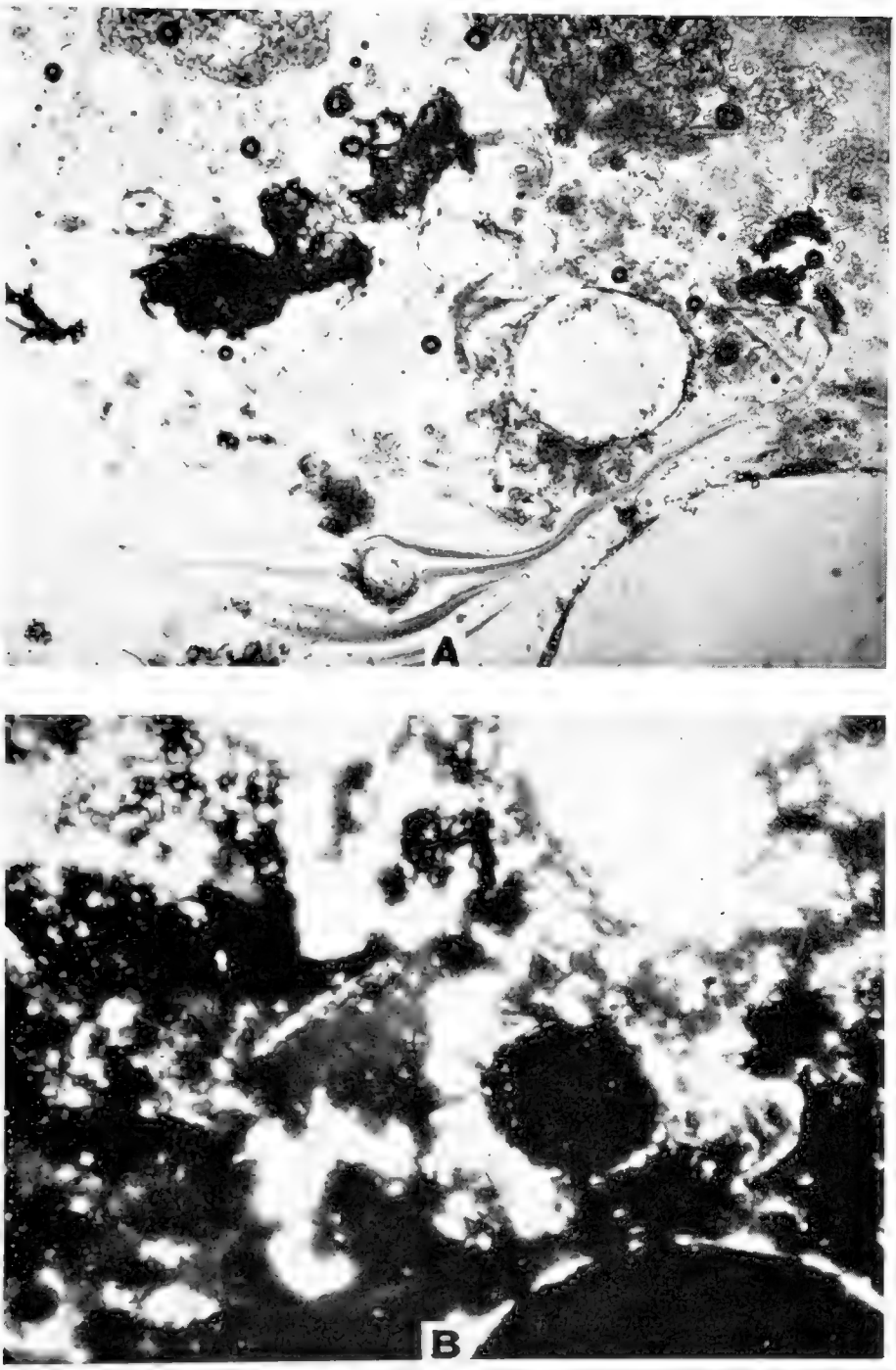


Plate X. (×108).—Thin sections of hay-silica glass.

A = ordinary light;

B = polarized light.

Showing smoky streaks, small and larger bubble cavities, carbonized plant fragments (black in A) and birefringent crystal clusters (white in B).

AUSTRALITES FROM NURRABIEL, WESTERN VICTORIA.

By George Baker, Honorary Associate in Mineralogy, National Museum of Victoria.

Contents.

Abstract.

Thirty-nine australites (Australian tektite glass bodies) were discovered in 1961 resting upon an old soil horizon exposed on removal of a thin cover of sand by the process of local deflation, at Nurrabiel, 16½ miles south-south-west of Horsham in the Western District of Victoria. They reveal most of the characteristic shape types represented in collections of australites from other districts in Western Victoria.

Although relatively well-preserved, they are more abraded than specimens naturally released from soils in the Port Campbell district, 128 miles to the south-south-west, but are generally much better preserved than the majority of the more numerous specimens of australites recovered from the marginal lands and more arid regions of South Australia, Central Australia and Western Australia.

Two unusual forms are a thin and slender canoe-shaped australite and an elongated, thin, bowl-like australite, each weighing approximately only 0·1 gms. Features of significance are (i) a clockwise spiral flow ridge on the anterior surface of a teardrop-shaped australite, and (ii) an internal cavity 9 mm. across exposed in one of the gibbosities of a dumbbell-shaped australite as a consequence of natural flaking.

Several of the forms have been fractured and some of these flaked further by natural means, but three fragments reveal evidence of aboriginal manufacture. A complete flange from an australite button, provides evidence of separation as an entire detached entity from the central body portion as a result of natural, terrestrial weathering.

Introduction.

Thirty-nine australites were discovered during an organized search of a large sand blow on the property of Mr. McDonald 1 mile west of Nurrabiel State School. The search was conducted at the end of April, 1961, under guidance in the field by Mr. Eric Barber, President of the Field Naturalists Club of Horsham. The locality lies approximately 16½ miles south-south-west of Horsham in Western Victoria, and 180 miles west-north-west of Melbourne. As a result of two and a half hours searching by seven people, it is believed that all of the australites and fragments exposed at the time, were recovered from the site. Others, however, could be later exposed by further superficial weathering of the surface of the ground. It is notable that the area searched yielded examples from all the usual australite shape types except the lens group.

The australites rested upon the surface of an old soil horizon uncovered by deflation and local wind erosion of a thin cover of drift sand. Once freed of enveloping finer soil components, they were exposed to abrasion by wind-borne quartz sand which has a hardness value slightly greater than that of australite glass. Most of the specimens occurred at the lower (western) end of a gently sloping, wind-swept and rain-washed soil surface approximately 1,600 square yards in area. None was located on the quartz sand accumulations that had drifted across this area.

Associated with the australites on the old soil horizon were numerous aboriginal flakes and occasional implements prepared from flint, chert, greenstone and other rocks. There was very little buckshot gravel, which is often a common associate of australites found *in situ* in various parts of the extensive Australian tektite strewnfield.

Other australites from areas some 33 miles south-west and 30 miles south-south-west of Nurrabiel have been recently described (Baker, 1955B; 1959B).

Degree of Preservation.

The specimens are rather worn compared with many of the well-preserved, excellent specimens recovered from the Port Campbell district (Baker, 1937; 1940A; 1940B; 1944; 1946; 1957; 1959A; 1960A; 1960B; 1961A; 1962), and the Moonlight Head district (Baker, 1950) on the south coast of Western Victoria. This is largely because they have been exposed to abrasion by quartz sand drifting over them. Several, however, are in a rather better state of preservation than others, and reveal structural features in part accentuated by solution-etching during partial or complete burial in soils. They match some of the not so well-preserved Port Campbell australites and are better preserved than most of the Nirranda (Baker, 1956) australites. Such specimens were evidently more recently released from the old soil horizon than the abraded specimens.

On the whole, the specimens are in a much better state of preservation than most of the more common and badly weathered australites that have been found in the sub-arid to arid parts of the Australian tektite strewnfield (cf. Baker, 1961C; 1961D), such as parts of South Australia, Central Australia and Western Australia.

Proportions of Shape Types Represented.

Omitting the naturally produced nondescript fragments (see Table 1) and the flakes prepared by aboriginal craftsmen (cf. Baker, 1957), none of which provide sure evidence of derivation from a particular australite shape group, the collection of Nurrabiel australites is constituted of 57 per cent. of forms that

are round in plan aspect and 43 per cent. elongated forms. The proportion of elongated forms is rather high, for in larger collections and throughout the australite strewnfield generally, round forms exceed elongated forms in the ratio of 2·4 : 1.

Including the naturally flaked nondescript specimens, but not those flaked by aborigines, 43 per cent. of the collection consists of fragments resulting from the effects of terrestrial erosion. The remainder consists of better preserved, recognisable forms, none of which is entirely complete (*note*: the complete, detached flange [Table 1, No. 17] is virtually entire in itself, but has broken from an australite button).

Weights, Specific Gravity Values and Dimensions.

Of the 39 australites found at Nurrabiel, only 34 are described in detail herein. Five specimens remained in the possession of a resident in the Horsham district and were not available for detailed investigations. These five included a large oval core, a badly chipped and pitted flanged button, a canoe-shaped form with flange remnants, and two nondescript fragments.

The weights, specific gravity values and dimensions of the other 34 specimens are listed in Tables 1 and 2, together with a brief description indicating the australite shape types and the finders of the specimens (in Table 1).

Notes on Table 1.

Specimen No. 25 was obtained from a sand blow, near hall, north side of Noradjuha—Horsham-road, 7 miles south-east of Horsham. All others are from a sand blow one mile west of the State School, Nurrabiel. The total weight of these 34 australites is 63·048 grams.

Arrangement in Tables 1 and 2 is according to different shape groups; the specimens constituting each shape group are listed in order of decreasing weight.

Specific gravity determinations were made on a chemical balance using distilled water (T = 14·4° C.).

The lowest specific gravity value obtained is for an australite button (No. 1, Table 1). The low value (2·374) may be due to internal bubbles, but none could be detected on holding the specimen to a strong light.

The distribution of the specific gravity values is shown in Figure 1.

TABLE 1.

Weights and specific gravity values of Nurrabiel australites.

	No.	Shape Type.	Plate No.	Weight (gms.).	Specific Gravity.	Finder.
ROUND FORMS	1	Button, with minute flange remnant ..	..	2·972	2·374	G. Baker
	2	Button, with minute flange remnant ..	I, F and G	2·563	2·393	E. Wall
	3	Button, with larger flange remnant ..	..	1·910	2·430	M. K. Baker
	4	Button, with larger flange remnant ..	III, E	1·746	2·456	G. Baker
	5	Button, with larger flange remnant ..	..	1·595	2·431	G. Baker
	6	Button, with larger flange remnant ..	II, A–C	0·932	2·421	M. K. Baker
	7	Core of button (conical from fracturing) ..	III, F	2·730	2·422	G. Baker
ELONGATED FORMS	8	Oval, with minute flange remnant ..	III, D	3·225	2·427	G. Baker
	9	Oval, with small flange remnants ..	III, G	0·879	2·462	E. Wall
	10	Boat, with flange remnants	III, A–C	2·387	2·423	M. K. Baker
	11	Small boat, with no flange remnants ..	..	0·527	2·417	M. K. Baker
	12	Dumbbell, core with flaked zone ..	IV, A–C	8·907	2·401	A. J. Wall
	13	Teardrop, without flange	V, A–C	11·050	2·416	G. Baker
	14	Teardrop, with small flange remnant ..	I, A–C	2·218	2·406	G. Baker
	15	Canoe, with flange remnants	II, G–I	0·096	2·400	M. K. Baker
	16	Elongated bowl..	II, D–F	0·100	2·422	M. K. Baker
	17	Complete detached flange	I, D–E	0·659	2·405	A. J. Wall
FRAGMENTS	18	Fragment of button plus flange	..	2·271	2·393	E. Barber
	19	Fragment of button with flange remnant ..	..	2·255	2·401	A. J. Wall
	20	Fragment of button with flange remnant ..	III, H	2·062	2·406	M. K. Baker
	21	Fragment of button with flange remnant ..	..	1·047	2·458	E. Wall
	22	Segment from flanged button	..	0·906	2·442	G. Baker
	23	Segment from flanged button	..	0·709	2·400	G. Baker
	24	Flange fragment from button	..	0·378	2·408	G. Baker
	25	Flange fragment from button	..	0·273	2·459	G. Baker
	26	Fragment of oval with flange remnants ..	..	2·028	2·429	E. Barber
	27	Fragment of oval with flange remnant ..	..	1·758	2·412	M. K. Baker
	28	Fragment of boat without flange remnants ..	..	1·081	2·423	M. K. Baker
	29	Nondescript fragment (?from edge of button)	..	1·077	2·420	E. Wall
	30	Nondescript fragment (?from edge of button)	..	0·107	2·414	M. K. Baker
	31	Nondescript fragment (flake–?aboriginal) ..	..	0·098	2·420	M. K. Baker
	32	Flake from australite (Aboriginal flake) ..	II, L–M	1·091	2·387	M. K. Baker
	33	Flake from australite (Aboriginal flake) ..	II, K	0·770	2·428	M. K. Baker
	34	Flake from australite (Aboriginal flake) ..	II, J	0·641	2·401	M. K. Baker

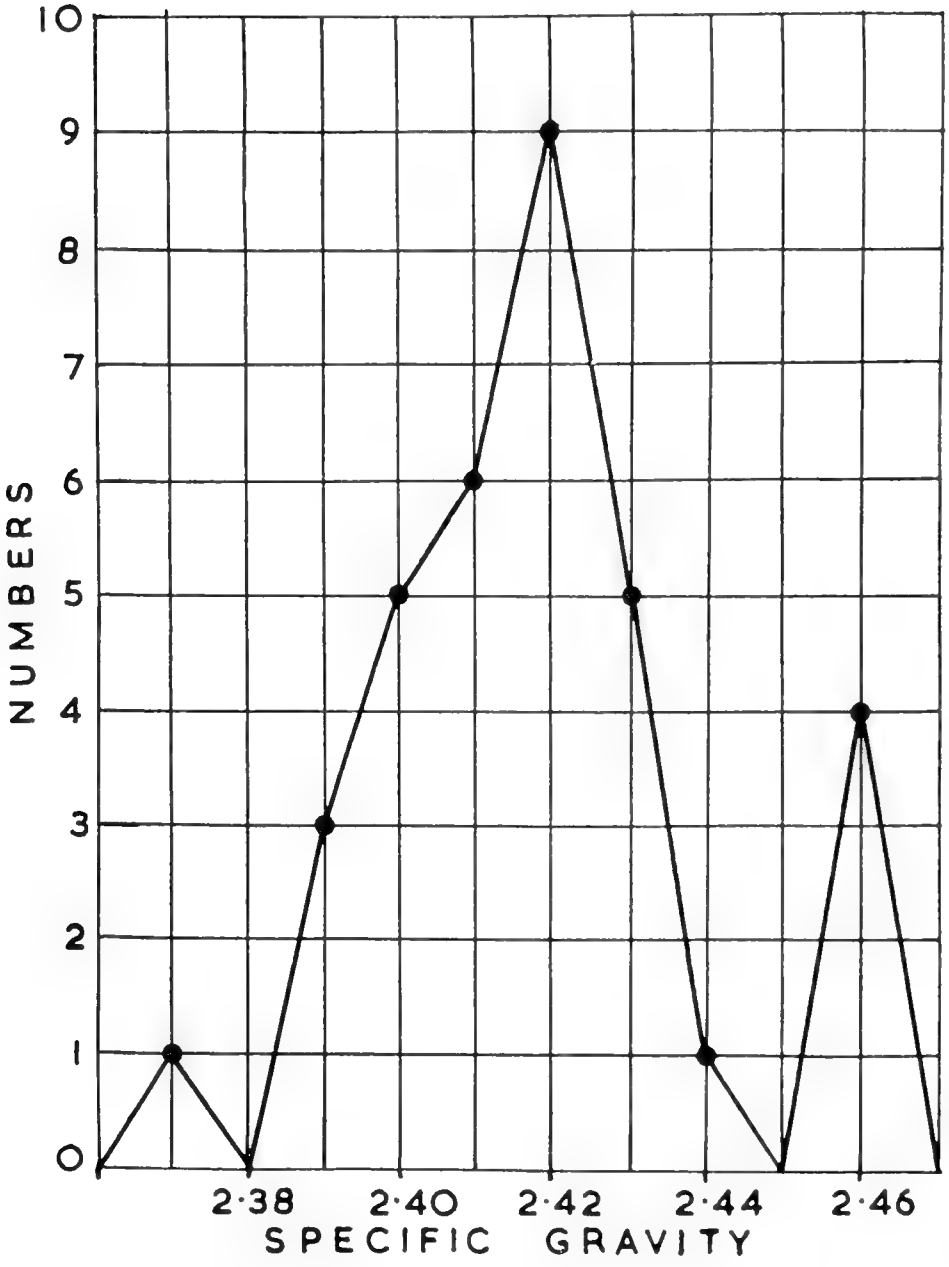


FIGURE 1.

Specific gravity frequency polygon for Nurrabiel australites.

In Figure 1, the specific gravity values of 34 specimens of australites found in the Nurrabiel district have been plotted, irrespective of whether they are fragments or nearly complete forms. The mode of the frequency distribution (2·42 for the 34 specimens) is a little greater than the arithmetic mean value (2·418).

TABLE 2.

Dimensions of Nurrabiel australites.

No.	Diameter (mm.).	Depth (mm.).	Width of Flange (mm.).	Width (mm.).	Length (mm.).	RB (mm.).			RF (mm.).		
						Across Di.	Across Wi.	Across Le.	Across Di.	Across Wi.	Across Le.
1 ..	16·5	9	..	..	..	10·0	..	..	11·2	..	..
2 ..	15	8·5	..	..	..	9·3	..	..	11·1	..	..
3 ..	14	7·5	2	..	..	10·0	..	..	9·4	..	..
4 ..	15	6	3	..	..	13·6	..	..	11·8	..	..
5 ..	14	7	2	..	..	8·6	..	..	8·8	..	..
6 ..	10	6	3	..	..	6·2	..	..	8·6	..	..
7 ..	17	8·5	..	..	..	15·4	..	..	9·3	..	..
8 ..	..	8·5	..	15	19	..	9·8	10·2	..	16·0	14·8
9 ..	..	5·5	..	10	11·5	..	5·8	7·2	..	9·1	7·4
10 ..	..	6	2·5	11	22	..	6·4	∝	..	8·7	30·2
11 ..	..	4	..	7·5	11	..	5·8	7·4	..	12·3	10·7
12 ..	..	10·5	..	16	40	..	9·6	15·6	..	..	..
13 ..	..	15·5	..	19·5	31	..	11·7	..	..	10·0	..
14 ..	..	8·5	..	12	18	..	6·5	12·7	..	8·5	10·2
15 ..	..	1·5	1	4·5	16·5	..	+	+	..	7·1	16·8
16 ..	..	2	..	2 to 3	12·5	..	+	+	..	1·2	9·7
17 ..	15	3	3	..	..	..	..	..	..	..	..
18 ..	..	9·5	4	..	..	11·6	..	..	12·7	..	..
19 ..	21	8·5	2	..	..	11·4	..	..	..	..	..
20 ..	18·5	9	2·5	..	..	13·4	..	..	12·4	..	..
21 ..	..	7	3	..	..	..	..	..	..	..	..
22 ..	..	..	4 to 5	..	..	..	..	..	..	..	..
23 ..	..	..	4	..	..	..	..	..	..	..	..
24 ..	..	3·5	3	..	..	..	..	..	..	..	..
25 ..	..	4	3·5	..	..	..	..	..	..	..	..
26 ..	..	9·5	2·5	15·5	..	..	7·7	11·0	..	8·5	12·3
27 ..	..	7·5	3	..	17	..	9·5	16·7	..	7·4	20·0
28 ..	..	6·5	..	10·5	..	..	8·0	∝	..	6·1	9·7
29 ..	..	..	..	..	..	..	..	..	..	..	..
30 ..	..	..	..	..	..	..	..	..	..	..	..
31 ..	..	..	..	..	..	..	..	..	..	..	..
32 ..	..	3·5	..	10	17	..	..	..	..	..	..
33 ..	..	5	..	10	13·5	..	..	..	..	..	..
34 ..	..	4·5	..	7·5	17	..	..	..	..	..	..
Range ..	10–21	1·5–15·5	1–5	2–19·5	11–40	6·2–15·4	5·8–11·7	7·2–∝	8·6–12·7	1·2–16·0	7·4–30·2

Notes on Table 2.

Numbers in the first column refer to the same specimens listed in Table 1.

Measurements of diameter, depth (= thickness), width and length were made to the nearest 0·5 mm. Measurements and calculations for the radii of curvature of the posterior (back = R_B) and anterior (front = R_F) surfaces of the australites were taken to the nearest 0·1 mm., using enlarged silhouettes (× 7·5) for the measurements (cf. Baker, 1955A). Radii of curvature measurements could not be satisfactorily determined on several specimens owing to incompleteness of some due to fracturing, and extensive wear of others due to abrasion and advanced solution-etching. Silhouettes of the better preserved specimens were obtained by adjusting them so that the outline traces would be equivalent to sections through their polar regions.

Measurements of the nondescript fragments (Nos. 29–31, Tables 1 and 2) are not given because they do not appertain to any particular shape group. Measurements of the aboriginal flakes from the australites (Nos. 32–34, Tables 1 and 2) are given to indicate their size as micro-implements (Plate II., Figs. J–M), but again the measurements do not appertain to any particular australite shape group.

∝ refers to specimens with virtually flat, or nearly flat, surfaces along their longer axes, e.g., Nos. 10 and 28, Table 2 (cf. Plate III., Fig. B).

+ = arcs of curvature across widths and along longer axes of posterior surfaces of canoe-shaped form (No. 15, Table 2) and of elongated bowl (No. 16, Table 2) are negative in sense and radii therefore not given (cf. Plate II., Figs. H and E). Radii of arcs of curvature for the two teardrop-shaped forms (Nos. 13 and 14, Table 2) were determined for the "gibbose" portions of the specimens (i.e. neglecting the "tail" portions); it was not practicable to measure R_B or R_F along the length of specimen No. 13 (cf. Plate V., Fig. B), and the smaller "tail" portion of No. 14 (Plate I., Fig. B) was neglected. R_B was determined for the dumbbell-shaped form (No. 12, Table 2) across the bulbous ends, each side of the waist, but R_F was not determined because of the naturally flaked character of the anterior surface (cf. Plate IV., Figs. B and C).

Arcs of curvature across the diameters of round forms and across the widths of elongated forms, except where local tertiary modifications of erosion had occurred, satisfactorily coincided with the arcs of curvature of constructed circles (cf. Baker, 1955A) having the radii listed in Table 2. Small departures from coincidence along the lengths of elongated specimens, however, occurred in the magnified silhouettes (× 7·5) in the polar and equatorial regions of the curved surfaces of specimens Nos. 8, 10, 16, 27 and 28.

The ranges and average values of the weight and specific gravity, and the average dimensions of round forms, elongated forms and fragments are shown in Table 3. Average values of the dimensions are not given for fragmented forms as such, except where they reveal some dimensions applicable to the forms from which the fragments were broken.

TABLE 3.

Showing ranges and average values of weight and specific gravity, and average dimensions of round forms, elongated forms and fragments of australites from Nurrabiel, Western Victoria.

	Round Forms.	Elongated Forms.	Fragments of Round Forms.	Fragments of Elongated Forms.	Nondescript Fragments.	
Number of specimens	7	9	9	3	6	34
Range in weight (gms.)	0·932 to 2·972	0·096 to 11·050	0·273 to 2·271	1·081 to 2·028	0·098 to 1·091	0·096 to 11·050
Average weight (gms.)	2·064	3·265	1·173	1·622	0·631	1·854
Range in specific gravity ..	2·374 to 2·456	2·400 to 2·462	2·393 to 2·459	2·412 to 2·429	2·387 to 2·428	2·374 to 2·462
Average specific gravity	2·418	2·419	2·419	2·421	2·412	2·418
Average depth (mm.)	7·5	7·5	6·5	8·0	..	7·5
Average diameter (mm.)	14·5	..	18	..	..	15·5
Average width (mm.)	..	11	..	13	..	11·5
Average length (mm.)	..	20	..	..	..	20
Average flange width (mm.) ..	2·5	2·5	3	2·5	..	2·5
Average RB across diameter of round forms (mm.)	10·4	..	12·1	..	..	10·9
Average RF across diameter of round forms (mm.)	10·0	..	12·5	..	..	10·6
Average RB across width of elongated forms (mm.)	..	7·9	..	8·4	..	8·1
Average RF across width of elongated forms (mm.)	..	9·1	..	7·3	..	8·6

SURFACE FEATURES AND CHARACTERISTICS.

Round forms.

Button-shaped forms.

The button-shaped australite shown in Plate I., Figs. F and G is typical of many that have lost the greater part of the circumferential flange by weathering, leaving only two small stumpy remnants on diametrically opposed sides of the equatorial edges of the form. Their presence serves to classify the specimen in the group of australite buttons. The secondarily developed

anterior surface (cf. Baker, 1959A) of the form (Plate I., Fig. G) has been further modified by the tertiary effects of weathering, largely solution-etching (Baker, 1961D) which has accentuated the sub-surface internal schlieren, and removed all but traces of the originally sharp-crested flow ridges that are so well developed on excellently preserved australites (cf. Baker, 1944; 1959A; 1961A; 1962).

Although collected nearby, within a few yards, the smaller button shown in Plate II., Figs. A to C, is in a better state of preservation. Much of the flange has been lost by piecemeal fracturing and the still attached remnants subjected to solution-etching, particularly along inrolled planar spiral internal schlieren (cf. Baker, 1944: 1958). However, the posterior surface of the lens-like core (Plate II., Fig. B) has been little affected by solution-etching or by abrasion, and the crests of the concentric flow ridges (Baker, 1956) on the anterior surface are still sharply delineated.

Comparisons between the specimens shown in Plate I., Figs. F and G and Plate II., Figs. A to C, lead to the conclusion that in one and the same relatively small area, different degrees of solution-etching and abrasion can operate to produce differential weathering effects on australites. These two specimens were located relatively close to one another on an area where it is unlikely that either was moved by natural agencies more than a few feet from the original position where they landed upon the earth's surface. However, one specimen (Plate I., Figs. F and G) was evidently released from its soil environment earlier than the other (Plate II., Figs. A to C).

The anterior surface of a button-shaped australite with minor remnants of the flange still attached in diametrically opposed positions (left- and right-hand sides of Plate III., Fig. E), has been affected by solution-etching to the extent of the development of minute etch pitting and accentuation of occasional flow lines that radiate outwards from the stagnation point region (cf. Baker, 1961A) to the equatorial edge of the core. As a further consequence of etching effects, the innermost flow ridges have been reduced to low, vaguely defined structures, but the outermost flow ridge still reveals a sharp, clearly defined crest, in places interrupted in continuity by narrow, slightly overdeepened radial flow lines.

Core form.

The core of a round form (Plate III., Fig. F) is characteristically conical in side elevation, and thus typical of the manner in which buttons are affected by relatively advanced stages of weathering. The circumferential flange has been totally removed, followed by flaking of adjacent portions of the anterior surface rather regularly all around the periphery of the form. Inasmuch as the posterior surface, which is a primary feature of australites, has not been flaked away, and the flaked equatorial zone is evidently not an outcome of aboriginal workmanship, it would appear that the conical core is a stable remnant rather more resistant to terrestrial erosion than are either the secondarily produced circumferential flanges or anterior surface regions of australites.

Complete flange.

Plate I., Figs. D and E shows the smoother posterior and the contrasting flow-ridged anterior surfaces respectively of a complete, detached flange that is circular in plan aspect. It has been separated by natural processes from a central lens-like body core to which it was originally circumferentially attached to form a flanged australite button. There are only about 30 such complete detached flanges known, most of which (25 well-preserved specimens) are from Port Campbell, Victoria (cf. Baker, 1946, Plate XIII.) and two (poorly preserved examples) are from the Nirranda district (Baker, 1956, Plate I., Figs. 4 and 5), Western Victoria.

Elongated forms.

Oval-shaped forms.

The two oval forms (Plate III., Figs. D and G) reveal stages of weathering of a rather different type. Both have lost the greater part of the circumferential flange and all the flow ridges have been obliterated from the anterior surfaces. The larger oval (Plate III., Fig. D) has been dulled by abrasion and shows minor markings probably caused by collisional impact of smaller size material such as wind- and water-borne sand grains. The smaller oval (Plate III., Fig. G) retains a vitreous lustre due to accentuation by solution-etching, a process that evidently dominated the effects of abrasion.

The fact that circular and slightly elliptical cupules appear on the posterior and anterior surfaces of both the central lens-like core and the remnants of the circumferential flange, is evidence

that these features are essentially solution etch pits, for the posterior surfaces of circumferential flanges and the anterior surfaces of australites in the well-preserved state, are typically free of such pittings. The pits are 0·25 mm. to 1·5 mm. across and range in depth from a fraction of a millimetre to 0·5 mm. Where the shallower pits are more crowded together, their walls meet as low, narrow arêtes, and the general appearance is that of hammered metal. Where flow lines have become accentuated by solution-etching, they can be occasionally observed trending across smoother, less pitted surfaces and continuing around the walls of the solution pits. Occasionally smaller pits are developed at the bottoms of the larger pits. Evidently these pits result from differential solution-etching along bundles and small swirls of schlieren trending normal to the surface and dipping into the body of the specimen as part of its complex internal flow line pattern.

Boat-shaped form.

The boat-shaped form (Plate III., Figs. A–C) is less-weathered than the two ovals; it shows some signs of abrasion and solution-etching, and has lost approximately 65 per cent. of its circumferential flange by fracturing. The posterior surface (Plate III., Fig. A) reveals an elongated flow-swirled area occupying the greater part of the surface and with its longer axis parallel with the long axis of the boat-shaped form. In side aspect the flat-topped nature of the posterior surface (left-hand side of Plate III., Fig. B) contrasts with the arc of curvature of the anterior surface (right-hand side of Plate III., Fig. B) but in end-on aspect, the appearance is that of flanged buttons such as shown by Plate II., Fig. B. The anterior surface (Plate III., Fig. C) reveals the concentric nature of the flow ridges which parallel the outline of the boat-shaped form and are crossed in places (see bottom right of Plate III., Fig. C) by flow lines made prominent by solution-etching.

Dumbbell-shaped form.

The dumbbell-shaped form (Plate IV., Figs. A to C) has been subjected to fairly considerable natural flaking of the equatorial regions and anterior surface, producing a marked flaked equatorial zone (Baker, 1940, p. 488) somewhat similar to that of the round core shown in Plate III., Fig. F. One effect of the flaking by weathering has been to expose an internal bubble-cavity 9 mm. in diameter in one of the gibbose portions of the dumbbell—(left-hand end, Plate IV., Figs. B and C).

The walls of internal bubbles in australites invariably reveal a highly vitreous lustre (" hot polish ") in the freshly exposed condition (Baker, 1959A; 1961B). The fact that the walls of the cavity in this dumbbell are as dulled as the flaked surfaces, indicates some degree of antiquity since the initiation of flaking and the exposure of the internal cavity. Small amounts of solution-etching have accentuated some of the internal schlieren, producing fine, shallow, narrow depressions along the flow-line directions.

No australite dumbbell has been observed previously with an internal cavity as large as the one in this specimen from Nurrabiel, but larger internal cavities are known in round forms (australite buttons, lenses and cores) and in other elongated forms (australite ovals and boats). Most of the common shape groups of australites are thus now known to contain specimens with relatively large internal cavities, the observed range in size of which is from 5 mm. to nearly 50 mm. (cf. Baker, 1961B) across. Internal cavities have so far been more frequently observed in the round forms of australites. Smaller cavities are more common from under 5 mm. down to a fraction of a millimetre in size.

Whereas one gibbose portion of this dumbbell contained an internal bubble of significant proportions, it is evident from the normal specific gravity value of the specimen (No. 12, Table 1) that neither the waist region nor the other gibbose portion contains bubbles of any significance. Furthermore, holding the specimen to a strong beam of light does not reveal the translucency that would be expected if large internal cavities were present in such parts. Then again, there is no evidence to show that larger internal cavities were present in either the waist region or in the more solid gibbose portion prior to fracturing. The significance of this occurence lies in the fact that despite the existence of an internal cavity in one gibbose portion and solid glass throughout elsewhere, the dumbbell-shaped form maintained aerodynamic stability in the line of flight during the phase of atmospheric frictional heating. Only under conditions of high entry velocity (cf. Baker, 1958; Chapman, 1960) could this be reasonably expected.

The posterior surface of the dumbbell (Plate IV., Fig. A) reveals smooth, flow swirled regions surmounting each gibbosity, with occasional bubble pitted areas, principally in the waist region. These are original features which have been accentuated in parts and partially to almost completely obliterated from other parts of the posterior surface as a consequence of terrestrial weathering.

Teardrop-shaped forms.

Plate I., Figs. A to C illustrates a relatively well-preserved teardrop-shaped australite on which little of the flange structure remains. It was developed as an apioid of revolution in the primary molten phase when generated in its extraterrestrial birthplace. Its present form is modified on one surface, and it provides convincing support for the contention that australites were not shaped while spinning as completely molten or plastic glass bodies through the earth's atmosphere. The formative stages of the secondarily produced anterior surface with its remarkable but characteristic features (Plate I., Fig. C), arose during a phase of atmospheric frictional heating, when, at ultrasupersonic speeds of non-rotary earthward infall, thin film melting occurred on the forwardly directed (i.e. anterior) surface of an originally cold, pre-formed shape that maintained aerodynamic equilibrium while the high speeds of entry prevailed. Temperatures sufficiently high to cause some ablation as well as melting were thereby attained, resulting in obliteration of the primary sculpture, and the generation of new sculptural elements on a surface that had progressively receded all over, including the stagnation point (i.e. front polar) regions right out to the peripheral regions of the form. The development of the anterior surface, with its spiral clockwise flow ridge (Plate I., Fig. C), is thus best explained in terms of the Aerodynamical Control Theory (Baker, 1958). Considerable difficulties arise if attempts are made to explain such a structure as developing on an imaginary molten or plastic body of tektite glass spinning rapidly during earthward flight. It is observed from Plate I., Figs. A to C, that the clockwise helical spiral shape assumed by the flow ridge is confined to one particular surface only, and that its axis (right to left in Plate I., Fig. B, and front to back in Plate I., Fig. C) is normal to the long axis (top to bottom in Plate I., Figs. A to C) of the original apioid. The longer axis would have been the spin

axis of the primary form, hence, even if it is possible, though rather unlikely, for a descending helical spiral flow structure to develop on a falling, spinning, molten or plastic apioid, it would have to be located normal to the long axis, and situated around the wider, lower end of the gibbose portion, with its point of origin at the bottom of the form, and its trend following around all parts of the gibbosity. Hence it would pass around the regions occupied by the anterior and posterior surfaces of the form, and there would be no distinctive anterior or posterior surfaces of the kinds shown by the specimen. Since this is obviously not the state of affairs, it becomes apparent that a falling, molten or plastic apioid, spinning about its long axis, would not produce the two differently sculptured surfaces revealed by the specimen, and generate a descending helical spiral flow ridge on one of those surfaces only. It is also inconceivable that rapid spinning of a similar body in either of the two planes normal to that containing the long axis of the specimen, could produce either the observed surfaces and structures, or the configuration of the form itself.

The formation of the helical character of the flow ridge in terms of the Aerodynamical Control Theory of the secondary shaping and sculpturing of australites (Baker, 1958), is best explained in the same way as for the clockwise helical spiral flow ridge developed on a perfectly preserved, complete, flanged oval australite from Port Campbell, Victoria (Baker, 1961A). An ablation pit that was evidently responsible for controlling the helical nature of the spiral ridge on the Port Campbell specimen, is not present on the Nurrabiel specimen. At the level of ablation attained, however, such a pit could have been just obliterated at the moment that the aerodynamical frictional heating effects ceased and the last formed features became frozen-in place.

Furthermore, the primary flow lines revealed on the posterior surface of the Nurrabiel teardrop-shaped australite (Plate I., Fig. A), trend towards the tail of the specimen, while immediately opposite on the anterior surface of the tail region, primary flow lines have been obliterated, the surface is generally smoother with the dominating features being the flow ridge and a few fine, radial flow lines trending across the surface of the intervening flow troughs (Plate I., Fig. C).

The larger teardrop-shaped australite (Plate V., Figs. A to C) does not reveal flow ridges on its anterior surface (Plate V., Fig. C) like the smaller teardrop (Plate I., Fig. C). If originally

present, they have been completely removed by weathering. Well-preserved forms of the size of this larger teardrop are particularly rare and reveal wrinkled and rippled ridges, as on a teardrop nearly 4 cms. long from Port Campbell, Victoria (Baker, 1959, Fig. 15, p. 67).

The radius of curvature across the width of the gibbose portion of the larger teardrop from Nurrabiel is less for the anterior than for the posterior surface, whereas the reverse holds for the smaller teardrop (cf. Nos. 13 and 14, Table 2). It is five times heavier than the smaller teardrop and has a slightly greater specific gravity. Both the anterior and posterior surfaces of the larger teardrop are equally weathered, and the rim separating these two surfaces (Plate V., Fig. B) is somewhat rounded but nevertheless distinct. There is evidence to show that some of the attenuated tail portion has been broken off, whereas in the smaller teardrop, much of the tail is preserved (Plate I., Fig. A), although not greatly attenuated.

Canoe-shaped form.

Incomplete because of the loss by fracturing of portions of its fragile, upturned, tapering extremities and its thin, narrow flange, the long and slender canoe-shaped australite (Plate II., Figs. G to I) nevertheless has lost little glass by weathering. It is the smallest, lightest-weight specimen (Table 1, No. 15) yet recorded in this shape group of the australites, and is unmatched for delicacy among the 45,000 or so australites known. It is so thin (0·5 mm. to 1·5 mm.) that the tektite glass is translucent throughout the whole of the specimen, even without strong illumination. Weighing 0·096 grams now, its original weight prior to loss of small portions by fracturing would have been little over 0·10 grams for the complete form. Obviously such a thin, elongated, delicate, flanged canoe-shaped form could not have been formed from the rotation of molten or plastic glass falling through the atmosphere. It is best interpreted as the thin end product of an ablated, originally larger canoe-shaped form, that was subjected to the comparable effects of aerodynamical phenomena that shaped and sculptured the other australites.

Fine, long flow lines parallel with the long axis of the form are evident on the posterior surface (Plate II., Fig. G) but the anterior surface is smooth (Plate II., Fig. I). The curvature and the backwardly directed nature of the tapered ends is seen in Plate II., Fig. H, in which the anterior surface is uppermost. This is the surface that was directed forward along the flight path during ultrasupersonic transit through the atmosphere.

Bowl-like form.

The remarkable elongated, bowl-like form (Plate II., Figs. D to E) which is pinched-in towards its central regions (Plate II., Figs. D and F), suggesting dumbbell-like characteristics, is likewise not quite complete. It is also thin, translucent throughout, and light in weight (0·10 grams). The walls of the bowl, which are only 0·5 mm. to 0·75 mm. thick, are minutely etch-pitted.

Natural fracture fragments.

The button fragment illustrated in Plate III., Fig. H is rather worn and reveals a so-called " saw-mark " (bottom of photograph) which is actually a curved groove overdeepened and widened by natural solution-etching along bundles of schlieren. It is frequently this type of groove that delineates the surfaces of conical cores (as in Plate III., Fig. F) and segments of buttons that become detached from them.

One of the oval fragments (No. 26, Table 1) reveals an internal cavity 5 mm. in diameter and 2 mm. deep on the fracture surface which trends across the width of the specimen. As usual, the internal cavity is situated nearer to the posterior than to the anterior surface of the specimen (cf. Baker, 1961B). The distance from the rear wall of the internal cavity to the posterior surface of the oval fragment is 0·5 mm. (in the narrowest part), whereas the front wall of the cavity is 4·0 mm. from the anterior surface. The depth of the specimen containing the cavity is nearly 9·5 mm. Reconstruction of the original oval form indicates that the cavity was approximately half way along the longer diameter, but it is displaced off-centre along the shorter diameter of the form. Its presence by no means affected the development of the normal sculptural elements, and the form evidently maintained a position of stable aerodynamic orientation while high speeds prevailed.

The remaining incomplete specimens and fragments of australites in the collection from Nurrabiel (Table 1, Nos. 18, 19, 21–25, and 27–31) are not described in detail as they show no important features. Principal interest in them centres around the fact that they are relatively strongly weathered. They show more or less equally developed etch-pitting on all surfaces of both the flange remnants and the remaining portions of central cores, except where abrasion has been dominant.

Aboriginal flakes.

The characteristic conchoidal fracture of the Australian tektite glass is well illustrated on the broken surfaces of the aboriginal flakes (Plate II., Figs. J to M). A subsidiary ripple fracture pattern is evident on some of the conchoidal surfaces, e.g., Plate II., Figs. J and K, and the relatively fresh appearance and vitreous, only slightly dulled lustre of the broken surfaces, points to no great age since these flakes were deliberately fractured by man from australites.

The specimen illustrated in Plate II., Figs. L and M shows the best re-touching by pressure micro-flaking around its edges; it is evidently a relatively flat, worked flake obtained from the posterior surface region of one of the larger types of australites —possibly a large boat-shaped form. The natural sculpture of the posterior surface of the original australite is preserved, but is rather more weathered than the fracture surfaces.

The specimen shown in Plate II., Fig. J was likewise derived from the posterior surface region of an australite. The original surface reveals pitting and an arc of curvature suggestive of derivation from an australite button.

The third aboriginal flake (Plate II., Fig. K) was fractured from the edge of an already much worn australite. The rim separating the pitted posterior surface remnant from a weathered equatorial zone, although rounded off by erosion, is nevertheless clearly marked. This fragment was probably derived from the edge of a specimen resembling the conical core illustrated in Plate III., Fig. F. Some weathering of the fracture surfaces has resulted in the initial manifestation of the schlieren in the glass as a faint but complex internal flow pattern.

Comparisons with Neighbouring Regions.

Nearby regions where australites have been found in sufficient numbers (fragments excluded) for comparison with those from Nurrabiel are situated at distances varying from 8 miles to 33 miles to the south, south-southwest and southwest of Nurrabiel. These regions are at Mount Talbot near Toolondo, Telangatuk East, Kanagulk, Balmoral and Harrow. This area of distribution covers some 600 square miles, which is approximately 0·03 per cent. of the total known australite

strewnfield, and the number of australite specimens recovered from the area constitutes 0·35 per cent. of the total number found so far throughout the vast strewnfield.

The average weight, average specific gravity, range in the specific gravity values, and the radii of curvature of the posterior (R_B) and anterior (R_F) surfaces of these separated groups of australites are shown in Table 4.

TABLE 4.

Comparison between australites from the Nurrabiel–Harrow–Balmoral regions of Western Victoria.

Locality.	Number of Specimens.*	Average Weight (gms.).	Range in Specific Gravity.	Average Specific Gravity.	Round Forms.		Elongated Forms.†	
					Average R_B (mm.).	Average R_F (mm.).	Average R_B (mm.).	Average R_F (mm.).
Kanagulk ..	29	9·75	2·38–2·44	2·40	13·1	12·2	14·7	12·6
Telangatuk East ..	9	6·69	2·38–2·44	2·41	13·4	13·6	11·6	10·8
Mt. Talbot, Toolondo ..	5	2·97	2·39–2·42	2·41	11·7	10·6	..	..
Balmoral.. ..	8	1·81	2·36–2·43	2·41	n.d.	n.d.	n.d.	n.d.
Nurrabiel ..	16	2·74	2·37–2·46	2·41	11·0	10·5	8·1	8·6
Harrow	33	8·97	2·39–2·47	2·42	14·8	13·7	16·6	14·7

*—Fragments excluded.

†—Measurements made across the shortest diameter.

Table 4 reveals that, based on average values, larger, heavier forms have been collected at Kanagulk, Harrow and Telangatuk East, while smaller, lighter weight forms occurred at Balmoral, Nurrabiel and Mount Talbot near Toolondo. This distribution of specimen size does not produce any particular pattern in the 600 square miles which it represents in the vast australite strewnfield of 2,000,000 square miles. There is, however, a tendency for lower specific gravity values to occur in the eastern part of the 600 square miles region, and higher specific gravity values (Harrow) to occur in the western part. A similar trend can be detected in the R_B values of the round forms. This means that the diameters of the original australite spheres from which australite buttons were produced were lower (22–23 mm.) in the eastern parts and greater (29·5 mm.) in the western parts of this portion of the australite strewnfield.

The distribution of shape types in five of the six australite concentration centres Balmoral details not available) listed in Table 4, are shown in Table 5.

TABLE 5.

Distribution of australite shape types at five neighbouring concentration centres in Western Victoria.

Shape Types.*	Kanagulk.	Mt. Talbot, Toolondo.	Telangatuk East.	Nurrabiel.	Harrow.	Totals.
Round Forms.						
Buttons	10	2	2	7	6	27
Lenses	4	3	1	0	4	12
Cores	5	0	2	1	10	18
Discs (flat)	0	0	0	0	0	0
Hollow forms	0	0	0	0	0	0
Bowls	0	0	0	0	0	0
Elongated Forms.						
Ovals	2	0	0	2	0	4
Boats	0	0	0	2	1	3
Cores	7	0	2	1	9	19
Dumbbells	0	0	1	1	3	5
Teardrops	0	0	1	2	0	3
"Aerial-bombs" ..	1	0	0	0	0	1
Canoes	0	0	0	2	0	2
Hollow forms	0	0	0	0	0	0
Plates (flat)	0	0	0	0	0	0
Bowls	0	0	0	1	0	1
Aberrants	0	0	0	0	0	0
Fragments.						
Complete flange	0	0	0	1	0	1
Flange fragments ..	0	0	0	2	0	2
Round form fragments ..	2	0	0	6	0	8
Round hollow form fragments	1	0	0	0	0	1
Elongated form fragments..	2	0	0	3	1	6
Nondescript fragments ..	0	0	0	8†	0	8
TOTALS	34	5	9	39	34	121

* Certain shape types are not represented at any of these five concentration centres. They are included for completeness; all of those listed occur in the Port Campbell concentration centre on the south coast of Western Victoria.

† Includes 3 flakes manufactured by aboriginal craftsmen.

Table 5 reveals that round forms and round form fragments together constitute 57 per cent. of the total number of forms collected, elongated forms and fragments of elongated forms constitute 36 per cent., and nondescript fragments 7 per cent. Button-shaped australites constitute the greatest percentage (22 per cent.) of any shape types, followed by round and elongated cores which are approximately the same (15 per cent. and 16 per cent.) as each other. Apart from lens-shaped forms (10 per cent.), all other shape types represented are each less than 4·5 per cent.

The greatest number of shape types is represented among the Nurrabiel australites, there being approximately twice as many as in the other concentration centres, although compared with the rich Port Campbell concentration centre, they contain only approximately two thirds of the known shape types. This may be largely a result of more detailed and more intensive searching in the Port Campbell concentration centre.

Conclusions.

Although lacking in well-preserved, perfectly complete specimens, the australites from the Nurrabiel district near Horsham nevertheless reveal some sculptural features of real significance that add further support to the " Aerodynamical Control Theory " of the shaping and sculpturing of australites (cf. Baker, 1958).

Sufficient of their external configuration remains to show that, like several other concentration centres in the more temperate regions of Australia where australites are usually in the better states of preservation than in arid and sub-arid parts of the strewnfield, the characteristic variety of a small number of shape types is represented. This indicates that the assemblage of shape types discovered is more likely an outcome of natural phenomena than of selective accumulation by aboriginal man. Even though found in association with aboriginal flakes and worked implements at Nurrabiel, on a relatively small area formerly under aboriginal occupation, it is considered likely that these australites occurred more or less where they originally fell. Some of the specimens were transported short distances (a few yards) across the slightly sloping surface on which they were found as a result of sheet run-off of occasional heavy rainfall, and a few were evidently used locally by the aboriginal occupants. Other, rather better preserved specimens have been much more recently released by slight amounts of erosion of the old soil surface on which they occur; such specimens were evidently not exposed at the time of aboriginal occupation.

References.

Baker, G., 1937.—Tektites from the Sherbrook River district, east of Port Campbell. *Proc. roy. Soc. Vic.*, 49 (2): 165–177.

Baker, G., 1940A.—Some australite structures and their origin. *Min. Mag.*, 25: 487–494.

Baker, G., 1940B.—An unusual australite form. *Proc. roy. Soc. Vic.*, 52 (2): 312–314.

Baker, G., 1944.—Flanges of australites. *Mem. nat. Mus. Vict.*, 14 (1): 7–22.

Baker, G., 1946.—Some unusual shapes and features of australites (tektites). *Mem. nat. Mus. Vict.*, 14 (2): 47–51.

Baker, G., 1950.—Section on "australites", pp. 35–36 of "Geology and Physiography of the Moonlight Head district, Victoria". *Proc. roy. Soc. Vic.*, 60: 17–43.

Baker, G., 1955A.—Curvature-size relationships of Port Campbell australites. *Proc. roy. Soc. Vic.*, 67: 165–219.

Baker, G., 1955B.—Australites from Harrow, Victoria. *Min. Mag.*, 30: 596–603.

Baker, G., 1956.—Nirranda strewnfield australites, southeast of Warrnambool, Western Victoria. *Mem. nat. Mus. Vict.*, 20: 59–172.

Baker, G., 1957.—The rôle of australites in aboriginal customs. *Mem. nat. Mus. Vict.*, 22 (8): 1–26.

Baker, G., 1958.—The rôle of aerodynamical phenomena in shaping and sculpturing Australian tektites. *Amer. Journ. Sci.*, 256: 369–383.

Baker, G., 1959A.—Tektites. *Mem. nat. Mus. Vict.*, 20: 5-313.

Baker, G., 1959B.—Australites from Kanagulk, Telangatuk East and Toolondo, Western Victoria. *Mem. nat. Mus. Vict.*, 24: 69–89.

Baker, G., 1960A.—Origin of tektites. *Nature*, 185: 291–294.

Baker, G., 1960B.—Comments on the recent letter on "Moldavites and similar tektites from Georgia, U.S.A." *Geochim. et Cosmochim. Acta*, 19: 232–233.

Baker, G., 1961A.—A complete oval australite. *Proc. roy. Soc. Vic.*, 74 (1): 47–54.

Baker, G., 1961B.—A perfectly developed hollow australite. *Amer. Journ. Sci.* 259: 791–800.

Baker, G., 1961C.—Australites from Wingellina, Western Australia. *Chemie der Erde*, 21 (1): 118–130.

Baker, G., 1961D.—Some aspects of the etching behaviour of australites. *Chemie der Erde*, 21 (1): 101–117.

Baker, G., 1962.—Volume relationships of well-preserved australite buttons, lenses and cores compared with their primary forms. *Chemie der Erde*, (3/4), 21 (2): 269–320.

Baker, G., and Forster, H. C., 1943.—The specific gravity relationships of australites. *Amer. Journ. Sci.*, 241: 377–406.

Chapman, D. R., 1960.—Recent re-entry research and the cosmic origin of tektites. *Nature*, 188: 353–355.

Acknowledgments.

The author is indebted to Mr. Eric Barber, President of the Field Naturalists Club of Horsham for guidance in the field, and to Mrs. M. K. Baker, Mrs. E. Wall, Mr. A. J. Wall and Mr. E. Barber for making available for detailed study the specimens found by them in the Nurrabiel area, near Horsham. The photographs were kindly prepared by A. W. Hounslow, B.Sc.

Description of Plates.

Plate I. (all × 2·5).

A to C—teardrop. A—posterior surface showing flow lines and pits. B—side view showing contrasting structures of posterior (on left) and anterior (on right) surfaces. C—anterior surface showing clockwise spiral flow ridge and radially trending flow lines. (*Note*: The anterior surface was directed down the flight path during ultrasupersonic flight through the atmosphere.)

D to E—complete flange naturally detached from an australite button. D—smooth posterior surface. E—flow-ridged anterior surface.

F to G—core of australite button with minor attached remnants of circumferential flange. F—posterior surface showing flow swirl and pitting. G—anterior surface showing sub-surface flow line pattern exposed by natural solution-etching.

Plate II. (all × 2·5).

A to C—small australite button with remnants of circumferential flange. A—posterior surface; B—side aspect with posterior surface uppermost; C—anterior surface. Outer edge of flange jagged (see B) due to solution-etching along inrolled planar spiral schlieren.

D to F—slender, elongated bowl-shaped australite, broken and worn at right-hand end.

D—posterior surface showing bowl-like interior, and narrowing of form at right-hand end;

E—side aspect, showing curvature of anterior surface;

F—anterior surface showing minute etch-pits.

G to I—slender thin (translucent) canoe-shaped australite.

G—posterior surface showing thin flange partly fractured from body portion at right-hand end;

H—side aspect with anterior surface uppermost;

I—anterior surface;

J—Aboriginal flake from an australite, showing conchoidal fracture surfaces with secondary ripple fracturing;

K—Aboriginal flake (?semi-discoidal scraper) from an australite, showing fracture surfaces with vitreous lustre.

L to M—Aboriginal flake from an australite.

L—showing fracture surface and re-touched edges of the australite glass;

M—showing portion of the posterior surface of the australite with solution-etch marks.

Plate III. (all × 2·5).

A to C—boat-shaped australite with remnants of attached flange.

A—posterior surface showing flow lines parallel with outline of the central core, elongated nature of the form, and more or less straight, parallel flange—core contact on left-hand side;

B—side aspect showing thickness of the form, (anterior surface on right-hand side);

C—anterior surface showing elongated flow ridges paralleling the outline of the form, and flow lines cutting across the flow ridges at bottom right-hand side;

D—posterior surface of broad oval-shaped australite with minute attached flange remnant at top right; showing minutely etched surface;

E—anterior surface of button core with minor flange remnants (= bulges in outline on left- and right-hand side); showing vitreous lustre and etched surface, with flow lines accentuated but flow ridges almost destroyed by solution-etching;

F—side aspect of conical core eroded from round (in plan aspect) australite. Posterior surface uppermost showing minute pits and sharply defined rim separating posterior surface and flaked equatorial zone;

G—posterior surface of smaller oval showing vitreous lustre and numerous pits; minute remnant of flange at bottom of photograph;

H—posterior surface of broken button showing solution-etch pitting of both central body core and attached circumferential flange. Solution "saw-groove" (bottom, centre) with infiltrated clay containing fine quartz sand.

Plate IV. (all × 2·5).

A to C—worn and flaked dumbbell-shaped australite.

A—posterior surface showing smoother flow-lined areas, occasional bubble pits, and constricted waist region;

B—side aspect showing waist region and flaked equatorial zone. Posterior surface is uppermost;

C—anterior surface, naturally flaked and eroded to reveal internal bubble cavity (at left-hand end).

Plate V. (all × 2·5).

A to C—larger teardrop-shaped australite.

A—posterior surface;

B—side aspect showing "rim" separating posterior (on left) from anterior (on right) surface;

C—anterior surface.

All surfaces are rather worn and have been affected by solution-etch pitting.

Addendum.

A large, almost round core from the earth bank of a dam at Lower Norton, 8 miles south-west of Horsham, has been recently loaned to the National Museum of Victoria by Mrs. J. Hannan of Horsham. The specimen was kindly made available by Dr. A. W. Beasley, Curator of Minerals at the Museum, for investigation.

It measures 50·5 mm. by 49 mm. and is 30·5 mm. deep. Its weight is 115·92 grams and the specific gravity, determined in distilled water at T = 12·5° C., is 2·429. The radius of curvature of the rear surface (RB) is 39 mm., that of the front surface (RF) is 45·5 mm.

Both the posterior and the anterior surfaces reveal a number of relatively shallow, circular to semi-circular etch marks 2 mm. to 5 mm. in diameter and resembling the "höfchen" and "tischchen" structures encountered on the surfaces of some specimens of the billitonites (= tektites found on the Island of Billiton). The specimen reveals a marked flaked equatorial zone (cf. Baker, 1940A) that is sharply delineated from the posterior surface by a strongly defined rim, but which grades less perceptibly, without so abrupt a change, into the anterior surface.

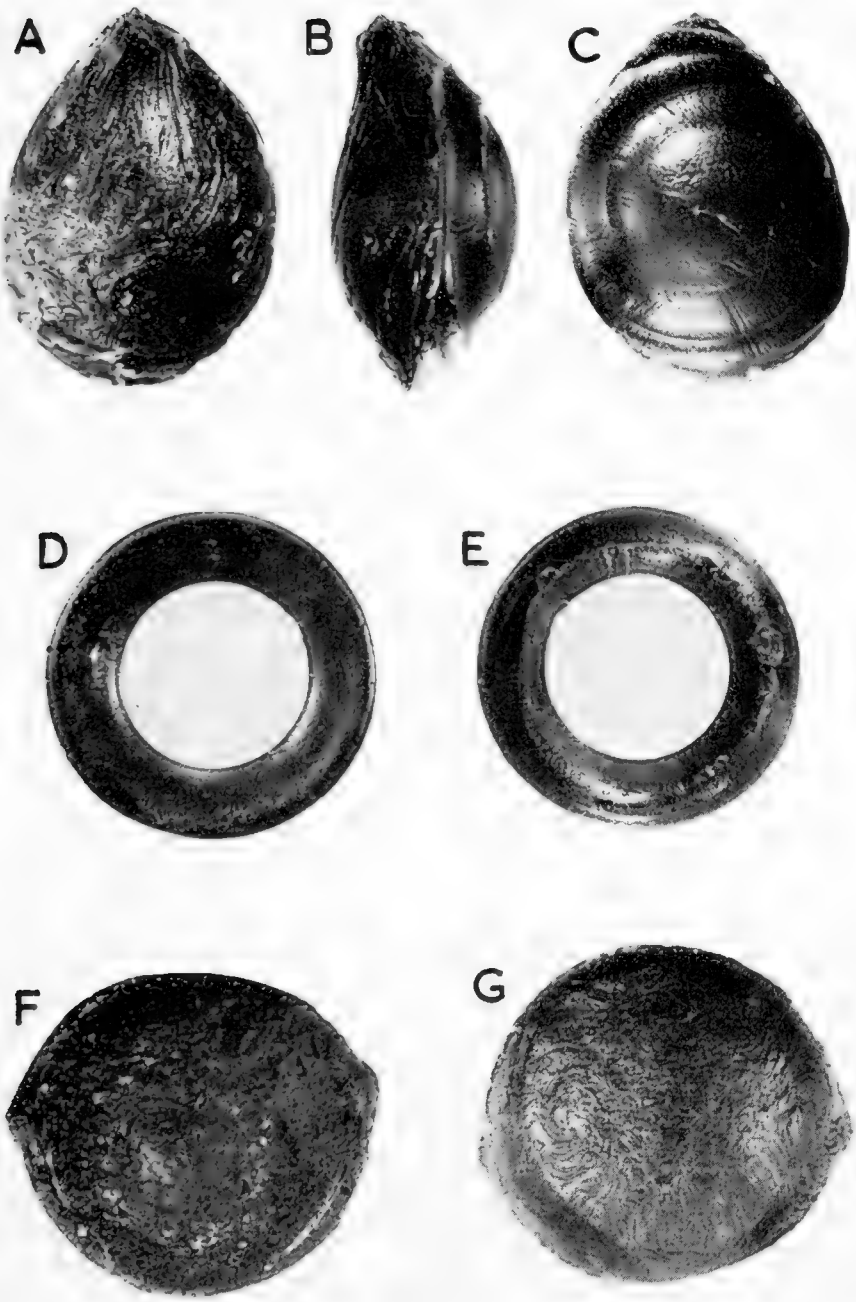


PLATE I.

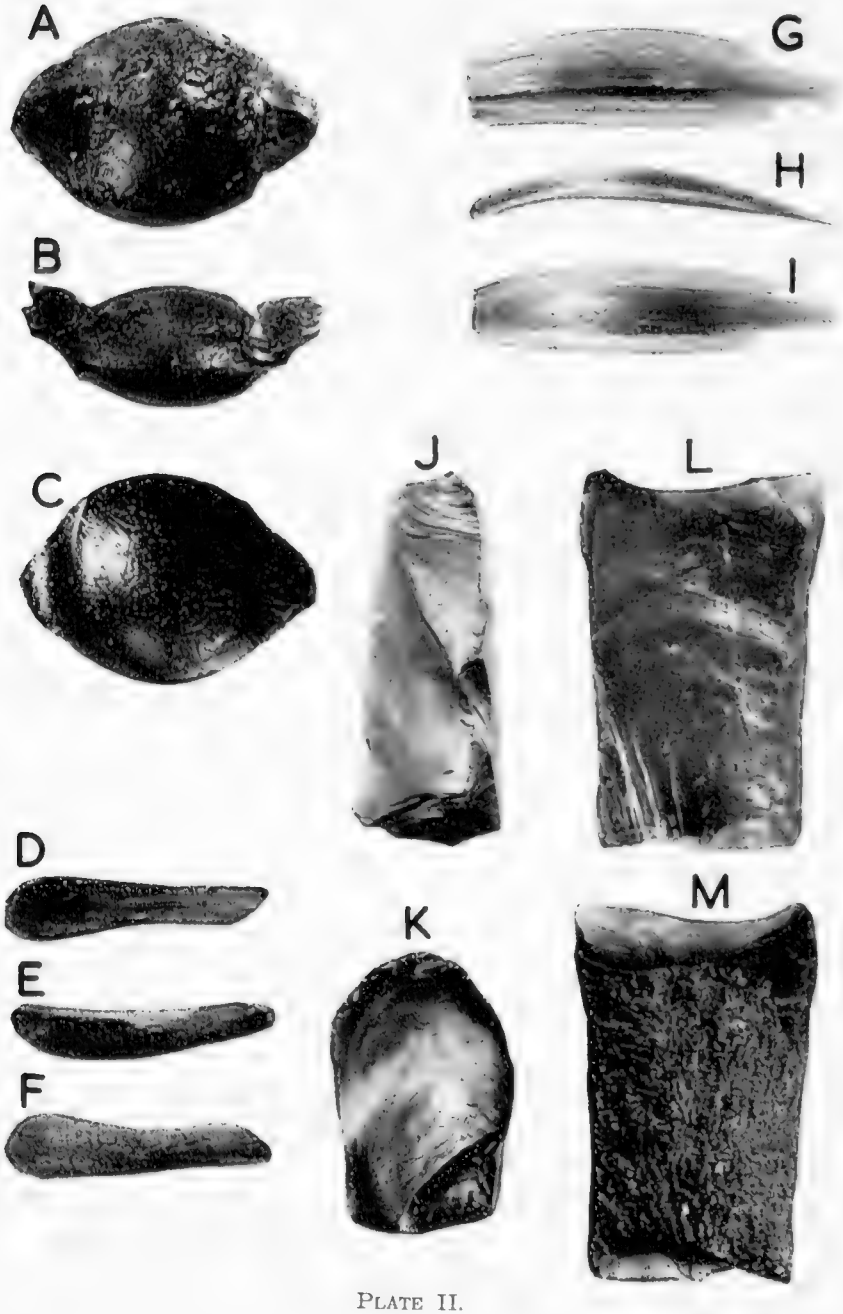


PLATE II.

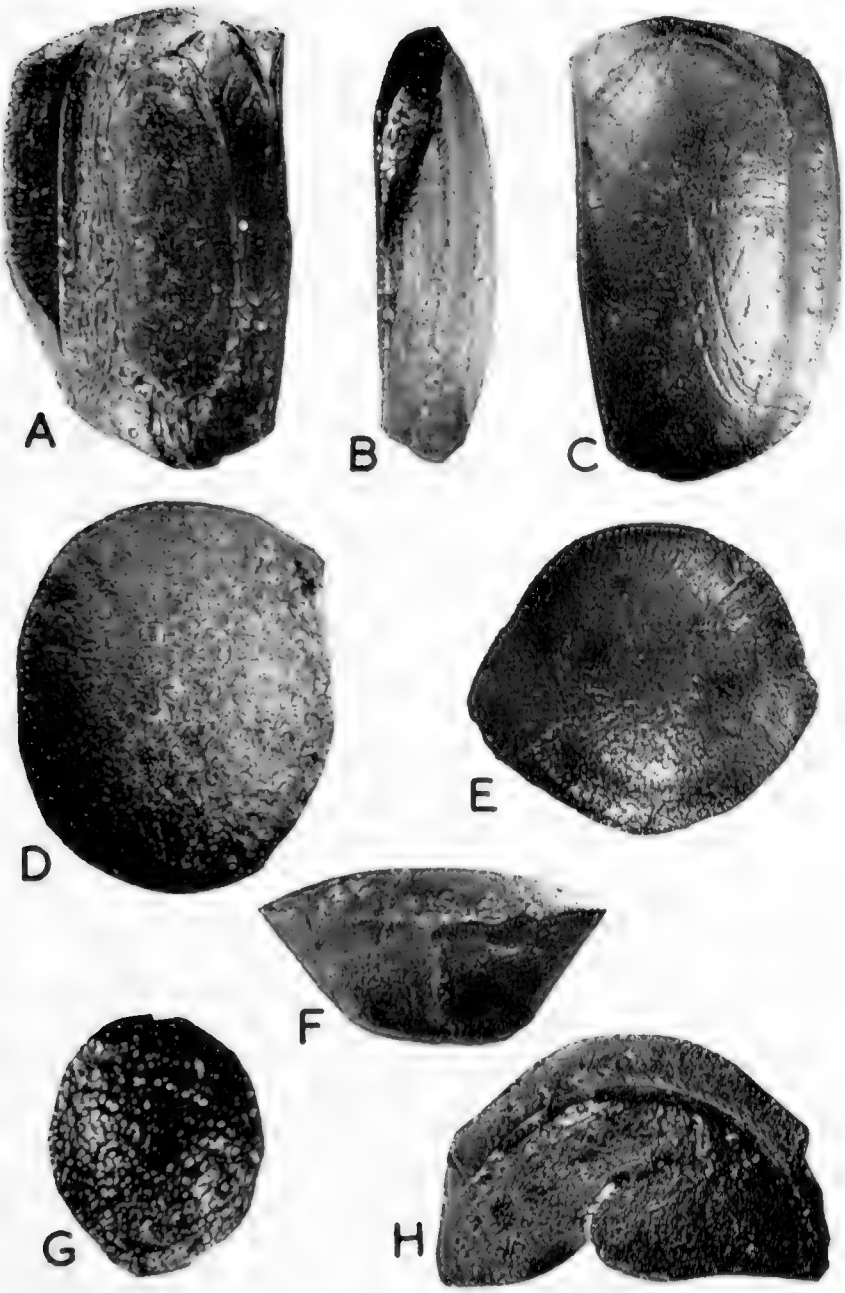


PLATE III.

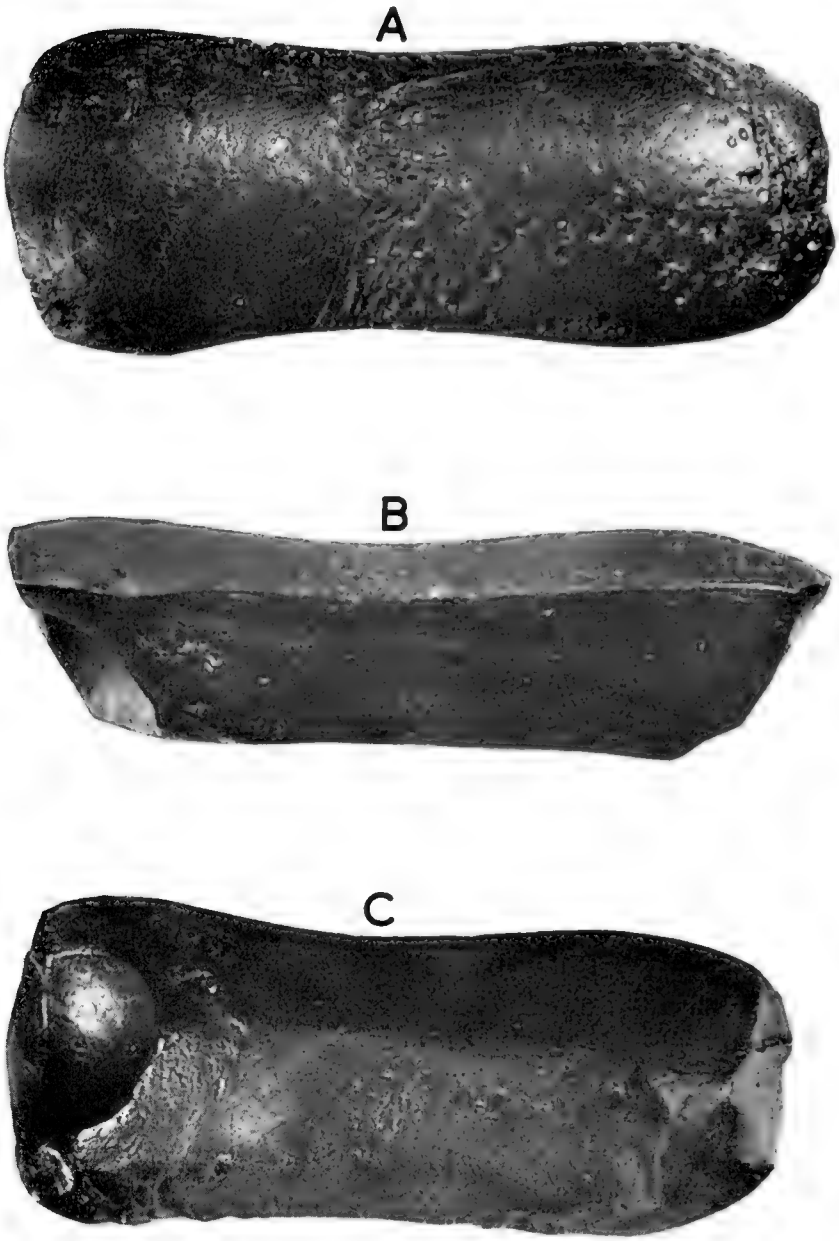


PLATE IV.

PLATE V.

REVISION OF THE GENUS *MACROTRISTRIA* STÄL (*CICADIDAE–HOMOPTERA–HEMIPTERA*) WITH DESCRIPTIONS OF NEW SPECIES.

A. N. Burns, Assistant Director, National Museum of Victoria.

ABSTRACT.

This genus which until now contained 16 species was erected by Stäl in 1870, and until 1900 included three species only. Thirteen more were added between the years 1901 and 1914. So far as is at present known, the genus is purely Australasian, all species coming from the mainland and closely adjacent islands with exception of Tasmania. Most of the species are tropical or sub-tropical, one only being found as far south as Sydney and the far north-west of Victoria. All the species are either large or fairly large in size, *M. angularis* (Germ.) being the largest with a total wingspan of 175 mm. (5 inches), and *M. vulpina* Ashton the smallest with total wingspan of 65 mm. (app. 2½ inches). All the species are showy insects—which occur during the summer months and inhabit open bushland or savannah forests. Within the genus the species fall into three groups as follows:—

(*a*) those with infuscation bordering cross veins and terminal branches of veins in forewings,

(*b*) infuscation bordering cross veins and with a spot at the end of each terminal branch,

(*c*) no infuscation at all.

Descriptions of six new species are given in this paper, two unfortunately being from single specimens only both of which are females; they are however quite distinct.

INTRODUCTION.

The distribution of species of *Macrotristria* is interesting, and ranges over varying types of country, especially in the tropical portions of the Continent where most species occur mainly in areas of rainfall of 50 inches and less. By far the most widely distributed and common species is *M. angularis* (Germ.) which ranges from the Mildura–Irymple area in Victoria, (the only area in that State where it is known to occur), New South Wales from a little south of Sydney to the Atherton tableland in North Queensland. Most of the other species are very much more restricted in their range of distribution, several are known only from very few specimens and single localities. All the species have a similar superficial appearance although the range and degree of colouration is very variable. All like to rest fairly high up in large trees and the song of the species of which I have records is loud, shrilling and audible at a considerable distance. Quite a number of species inhabit the dry interior and drier parts of the tropical north and north-west of the Continent, and even in these areas where similar conditions exist over very large

areas, are apparently fairly local. This really has yet to be proved because so little systematic collecting of these insects has been done in the more remote parts of the centre and north-west. Normally these are not easy insects to collect as they keep high up in the trees and so elude capture. To the known list of 16 species six more are now added, which are described and figured in this paper.

Summary of External Morphology.

Large to medium sized insects in which the sexes are very similar in appearance. Body robust and fairly long, its length averaging 2¼ times its width. Width of head equal to length of pro. and mesonotum; wider or equal to but not less than width of pronotum. Length of the latter equal to the portion of the mesonotum from its anterior margin to the proximal margin of the cruciform elevation. Pronotum with three sulci on either side of midline, its lateral margins with an anterior lobe. Head and thorax not strongly sculptured, in most species either smooth or slightly "marbled", slighly vermiculate in a few. Frons strongly convex, length exceeding twice its width; rostrum extending as far as the anterior margin of the posterior coxae. Ocelli closely or fairly closely grouped, anterior ocellus in line with or in front of anterior margin of eyes. Anterior wings three times as long as broad, approximately one and a quarter times body length. Length of posterior wings more than half that of anterior. Front femora only fairly strongly developed and with two large spines and a third very small spine or tubercle; posterior tibiae with five spines, two exteriorly, three interiorly. Cruciform elevation fairly strongly developed, the boundaries of the apex forming either a square or slight rectangle. Opercula at least reaching posterior margin of first abdominal segment beneath, may overlap slightly or have their inner margins close together but never widely separated. Opercular basal spine triangular and well developed, normally directed backwards and slightly outwards. The colour range of species in the genus is fairly wide, the ground colour usually being some shade of light or blackish brown, yellow or greenish; the head and thorax may be patterned with darker markings or be unmarked excepting for fasciae bordering the ocelli.

Key to the Species of Macrotristria.

1. Anterior wings with infuscation bordering all or some of cross veins and terminal branches of main veins, head wider than pronotum, opercula (males) extending only to posterior margin of first abdominal segment 2

2. (1) Frons reddish-brown with a yellow spot on vertex; cruciform elevation reddish-brown, its anterior arms curving inwards in a semi-circle, opercula brownish-black darkening towards base, their external angles openly rounded, internal angles acutely so .. *angularis.*

Frons with more than one yellow spot on vertex; cruciform elevation not reddish-brown, anterior arms of latter curving inwards more openly than in a semi-circle; opercula not brownish-black .. 3

3. (1) Frons deep black and with two small dark-yellow spots on vertex; cruciform elevation orange-brown; opercula yellowish-brown, basally black, their external angles rounded at about 90 degrees, internal about 70 degrees .. .. .. *maculicollis.*

Frons not deep black, cruciform elevation not orange-brown; opercula silvery pubescent and only yellowish-brown at base, their external angles obtuse, internal sharply rounded 4

4. (1) Frons dark brownish-black, cruciform elevation dark yellow with brown central marking, anterior arms slightly longer than posterior and almost straight; opercula yellowish-brown, silvery pubescent, their external angles obtuse, internal acutely rounded .. *hillieri.*

Frons and cruciform elevation lighter in colour, opercula not unicolorous, their external angles not obtuse 5

5. (1) Frons light chestnut-brown; cruciform elevation yellowish-brown lined yellow dorsally; opercula yellowish, dark brown basally, their external angles openly and evenly rounded, internal evenly so .. *occidentalis.*

Frons and cruciform elevation not light coloured; pseudopercula (female) not yellowish 6

6. (1) Frons blackish-brown; cruciform elevation blackish-brown anteriorly, reddish-brown posteriorly; pseudopercula (female) blackish-brown with external margins yellowish-brown .. *nanda,* sp. nov.

Frons and cruciform elevation not blackish-brown; pseudopercula (female) lighter in colour and graded 7

7. (1) Frons and cruciform elevation reddish-brown; pseudopercula dark brown grading to yellowish-brown basally .. *kabikabia,* sp. nov.

Anterior wings with infuscation bordering all or some of cross veins, terminal branches of main veins with a small infuscate spot adjoining ambient vein 8

8. Frons reddish-brown; cruciform elevation yellowish-brown; opercula dark reddish-brown, silvery pubescent, their external angles openly rounded, internal acutely so .. .. .. *thophoides.*

Frons similar but darker in colour and marked; cruciform elevation not yellowish-brown; opercula with external angles more than openly rounded 9

9. (8) Frons dark reddish-brown with a yellowish-brown marking down front; cruciform elevation dark reddish-brown; opercula dark reddish-brown, silvery pubescent, their external angles obtusely rounded, internal acutely so .. .. *hieroglyphica.*

Cruciform elevation and opercula not dark reddish-brown .. 10

10. (8) Frons dark reddish-brown, yellowish at junction with clypeus; cruciform elevation yellowish, it posterior arms longer than anterior; opercula black, may be yellowish near external margins, their external angles widely obtuse, internal acutely rounded .. .. *godingi.*

Cruciform elevation not yellowish, its posterior arms shorter than anterior 11

11. (8) Frons reddish-brown with a central black marking on vertex; cruciform elevation cinnamon-brown, its anterior arms slightly longer than posterior .. .. *nigronervosa.*

Frons slightly darker in colour and without a black marking on vertex; cruciform elevation not cinnamon-brown 12

12. (8) Frons dark reddish-brown with a yellow patch on vertex; cruciform elevation yellowish-brown; opercula yellow, silvery pubescent, their external angles openly rounded, interior acutely so .. *doddi.*

Frons not dark reddish-brown; cruciform elevation not yellowish-brown; opercula not yellow 13

13. (8) Frons green on vertex, middle front black, sides tinged brownish; cruciform elevation yellowish-green; opercula yellowish-green, silvery pubescent, their external angles about 90 degrees, internal evenly rounded .. .. *sylvara.*

Anterior wings without infuscation bordering cross veins; terminal branches of main veins without infuscation or infuscate spots .. 14

14. Frons and cruciform elevation reddish-brown; posterior arms of the latter slightly paler; opercula pale reddish-brown, silvery pubescent, their external angles obtusely open, internal very acute .. .. *nigrosignata.*

Frons not reddish-brown; opercula not pale reddish-brown, their internal angles not very acute 15

15. (14) Frons yellowish-brown; cruciform elevation pale yellowish-brown suffused pinkish, its posterior arms longer than anterior; opercula brownish-black, lighter near external margins, silvery pubescent, their external angles openly obtuse, internal rounded about 90 degrees .. .. *frenchi.*

Cruciform elevation not pale yellowish-brown its anterior arms slightly longer than posterior; opercula not brownish-black, their external angles not obtuse 16

16. (14) Frons and cruciform elevation yellowish-brown, anterior arms of latter slightly longer than posterior; opercula pale yellowish, minutely pustulate, their external angles about 90 degrees, internal fairly evenly rounded .. .. *extrema.*

Frons and cruciform elevation not yellowish-brown; opercula not unicolorous nor pustulate 17

17. (14) Frons and cruciform elevation dark chocolate-brown; anterior arms of the latter longer than posterior; opercula yellowish, chocolate-brown near basal spine, their external angles about 90 degrees, internal semi-circular .. .. *vulpina.*

Frons and cruciform elevation not dark chocolate brown, arms of latter not of unequal length; opercula with their external angles greater than 90 degrees and internal not semi-circular 18

18. (14) Frons and cruciform elevation yellowish-green or pale yellowish-brown, arms of latter equal in length, opercula pale yellowish-brown, their internal angles very openly obtuse, internal acutely rounded .. *dorsalis.*

Arms of cruciform elevation not of equal length; internal angles of opercula not obtuse 19

19. (14) Frons and cruciform elevation greenish-yellow; arms of latter short, posterior slightly longer than anterior; opercula yellow, minutely punctate, their external angles openly and gently rounded, internal acutely so .. .. *kulungura* sp. nov.

Frons partly greenish-yellow only; cruciform elevation not greenish-yellow; opercula not entirely pale yellow, their external angles not openly rounded 20

20. (14) Frons yellowish-green, its transverse ridges frontally marked with black; cruciform elevation yellowish-brown, its posterior arms slightly longer than anterior; opercula pale yellow, basally dark brownish-black, their external angles about 90 degrees, internal sharply rounded .. .. *bindalia* sp. nov.

Frons not yellowish-green; cruciform elevation not greenish-yellow or unicolorous; opercula not unicolorous 21

21. (14) Frons light reddish-brown; cruciform elevation yellowish becoming reddish at extremities of arms; opercula with inner halves black and outer yellowish, their external angles rounded at about 90 degrees, internal acutely but evenly rounded .. *douglasi* sp. nov.

Frons not entirely pale reddish-brown; cruciform elevation not yellowish; opercula unicolorous 22

22. (14) Frons pale reddish-brown, darker on vertex; cruciform elevation dark chocolate brown, its anterior arms longer than posterior; opercula pale yellow, their external angles about 90 degrees, internal rounded .. .. *worora* sp. nov.

Frons not reddish-brown; cruciform elevation not dark coloured, its anterior arms not longer than posterior; opercula not unicolorous, their internal angles not equally rounded 23

23. (14) Frons yellowish, transverse ridges marked with black on either side of mid-line; cruciform elevation pale yellowish-brown, its posterior arms longer than anterior; opercula pale yellowish, dark brownish-black basally, their external angles openly and gradually rounded, internal acutely so .. .. .. *intersecta.*

Macrotristria angularis (Germar).

Cicada angularis Germar, 1834, in Silb. "Rev. Ent." 2: 68.
Fidicina angularis Walker, 1850, "List. Hom. Br. Mus.": 78.
Cicada angularis Stäl, 1858, "Eugenies Resa." 4: 269.
Macrotristria angularis Stäl, 1870, "Ofv. Vet.-Ak. Forh.": 714.
Macrotristria angularis Froggatt, 1895, Proc. Linn. Soc. N.S.W.: 529.
Macrotristria angularis Froggatt, 1903, Agric. Gaz. N.S.W. 14: 418, fig. 1.
Macrotristria angularis Froggatt, 1903, "Misc. Public. No. 643": 8, pl. 2, fig. 1.
Cicada angularis Goding and Froggatt, 1904, Proc. Linn. Soc. N.S.W. 29: 580.
Macrotristria angularis Distant, 1906, "Syn. Cat. Hom." 1: 31.
Macrotristria angularis Froggatt, 1907, "Australian Insects": 350, fig. 157.
Macrotristria angularis Ashton, 1914, Trans roy. Soc. S. Aust. 38: 347.
Macrotristria angularis Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 99.
Macrotristria angularis Tillyard, 1926, "Insects of Australia and New Zealand": 162.
Macrotristria angularis McKeown, 1942, "Australian Insects": 98.

This is the largest and one of the first species included in the genus. Around Sydney it is commonly called "Fiddler" on account of the resemblance of its song to the rise and fall of loud notes of a fiddle. Another reason for that name may have arisen from its habit of sometimes moving its forelegs backwards and forwards as if using a fiddle bow. It is also sometimes referred to as "Cherry Nose" on account of the reddish colour of the frons. It has a wide range of distribution, could be regarded as the commonest species in the genus, and, with *M. hillieri* is the only representative of *Macrotristria* so far recorded from Victoria. It is particularly abundant along a wide coastal strip from Sydney to Brisbane, and its range extends as far north as the Cairns and Atherton tableland districts of North Queensland. Over this wide range it has developed slight colour changes; the typical form (described below) ranges from Sydney to Brisbane. Victorian specimens (Irymple–Mildura district only) have a slightly "blacker" appearance due to the darker infuscation bordering the cross and terminal veins in the anterior wings and the paler (creamy-yellow) spots on the head and thorax. Specimens from Mackay and North Queensland on the other hand are considerably paler in colour being brownish-black with larger and sometimes coalescing yellow spots on the head and thorax, and lighter infuscation bordering the cross and terminal veins in the anterior wings. It usually frequents high trees. Average body length, males (10) 45·7 mm., + 1·5 — 3·7; females (12) 46·4 mm.; + 3·6 mm. — 4·4 mm. Head black, almost smooth, with an orange transverse frontal band from eyes to frons, a triangular orange spot on vertex of frons, and a large similar spot adjoining each eye; a fine sulcus on either side of ocelli and medianally from anterior ocellus to posterior margin. Frons reddish brown, openly grooved medianally from vertical angle to clypeus, transverse ridges normally 14–15 in number. Ocelli pinkish orange vitreous, not equidistant, anterior slightly in front of eyes. Genae dull black or brownish black, lightly golden pubescent, exterior margins carinate and sometimes marked with orange below eyes. Antennae black; clypeus dark brownish black, keeled medianally, half length of frons; labrum shining brownish black, sides planate; labium black, reaching posterior margin of middle coxae. Eyes opalescent brownish black.

Thorax average width, males, 17·5 mm., females 18·9 mm. Pronotum black, almost smooth, three open sulci on either side of midline; median elongate orange spot with a smaller one (sometimes joined) adjoining posterior marginal

band, another orange spot on either side between first and second sulci; posterior marginal band wide, reddish brown or black, without markings, transversely striate; anterior margin dark yellow finely edged black, and with a distinct anterior lobe. Mesonotum black with an elongate orange spot on either side of midline and a more elongate similar spot just above lateral margins. Cruciform elevation reddish brown with anterior arms black from posterior margin of anterior depression. The latter often with a small, trilobed, dull orange spot. Metanotum dull black tinged orange laterally. Wings, anterior, average length, male, 53·5 mm., width 17·9 mm.; females 55·4 mm., 16·7 mm. Clear vitreous, veins yellowish brown, excepting costal which is black. Cross veins from R3 to R4 + 5, R4 + 5 to M1, M2 to M3, M4 to CU1a and CU1 to CU2 bordered black or blackish brown infuscation; also terminal branches of R3, R4 + 5, M1, M2, M3, M4, CU12, ambient vein from CU2 to terminal of R2, and portions of R4 + 5 and M1 between junctions of cross veins. Legs dark brownish black, anterior tibiae and tarsi black, anterior femora with 3 spines, anterior at halfway, second near distal, third and smallest almost at distal. Posterior tibiae with five spines, two on outer, three on inner margins; the first on outer at halfway, second near distal; first on inner margin opposite first on outer, second slightly less than half-way to distal, third half-way between second of outer and distal. Underside of thorax dull brownish black, silvery pubescent, prosternum yellowish laterally. Abdomen black, lightly invested with brown pubescence. Opercula brownish black gradually blackening towards base; left (seen from ventral) sometimes slightly overlapping right, external angles openly rounded, internal sharply curved, basal spine short, brownish black. Underside of abdomen dark brownish or brownish black, brown pubescence thickest along intersegmental margins and junction of tergites and sternites.

Type: ?

Macrotristria maculicollis Ashton

Macrotristria maculicollis Ashton, 1914, Trans. roy. Soc. S.Aust. 38: 347, pl. 12, fig. 1.
Macrotristria maculicollis Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 102.

This species in general appearance is very similar in colouration to the preceding, but may be at once separated by the four large yellowish spots on the posterior marginal band of the pronotum, its slightly smaller size, and the black frons with one large and two minute yellowish spots on its vertex. I have been able to examine three specimens only—(1♂ 2♀♀) all are from Dalby in Southern Queensland which may indicate that its distribution is local. These specimens were taken by Mrs. F. H. Hobler a niece of the late W. B. Barnard of Lepidoptera fame, at Toowoomba, Queensland.

Body length, male, 40·5 mm., female (average 2 specimens) 40·25 mm. Head wider than pronotum, deep black, almost smooth, an irregular shaped broad dark yellow band across front from each eye to posterior margin of frons, another large and two minute similar spots on vertex of frons; a shallow median groove from anterior ocellus to posterior margin, and a shallow open groove on either side of ocelli. Frons deep black, with a wide median groove from vertical angle almost to clypeus, transverse ridges normally 15–16. Ocelli pale pinkish vitreous, not equidistant; two posterior separated about one and a half times distance anterior and each posterior, anterior in front of line of eyes. Genae pale yellowish brown with black central patch, silvery pubescent, margin strongly carinate. Antennae black, Clypeus black, silvery pubescent, sharply keeled medianally; labrum dark brown anteriorly, sides black, planate, grooved medianally; labium black, also grooved, almost reaching posterior

margins of hind coxae. Eyes opalescent dark reddish brown. Thorax, width, male, 15·0 mm., female, 15·7 mm., black with dark yellow markings. Pronotum with three sulci on either side of midline, finely and openly sculptured; a dark yellow elongate spot crossing the inner sulcus on each side of median, posterior marginal band very wide, finely striate transversely, two elongate dark yellow dorsal spots and another smaller rectangular spot near each lateral margin; the latter black, carinate, with an openly rounded anterior lobe. Mesonotum black, smooth, two small dark yellow spots close together on mid-dorsal; on each side of these two larger elongate similar spots, one on dorsal the other near the lateral margin which is golden pubescent. Cruciform elevation not large, orange brown with ends of anterior arms black. Metanotum dark brown lined black. Wings, anterior, length, male, 50·0 mm., width 17·0 mm.; female 48·5 mm., 16·5 mm. Clear vitreous with veins dark brown excepting radial which is yellowish brown; cross veins from R3 to CuIa and terminals of all veins from these finely margined with translucent dark brown giving a thickened appearance. Posterior, length, male, 27·5 mm., width, 15·5 mm.; female, 18·5 mm., 16·25 mm.; clear vitreous, veins pale yellowish brown excepting 2A and 3A which are brown, margined pale yellowish brown. Legs with femora dark brown, tibiae and tarsi darker. Anterior femora with two large and one very small spine, anterior just before half-way, second near distal, third at distal. Posterior tibiae with five spines, two externally and three internally; first exterior at half-way, second near distal; first interior at one-third, second two-thirds, third almost at distal. Underside of thorax yellow, silvery pubescent, black round coxal insertions and near lateral margins. Abdomen black, smooth, with very light scattered silvery pubescence. Opercula yellowish brown with basal portions black, transversely striate; inner margin of left (seen from ventral) overlapping that of right; internal angles rounded at about 70 degrees, external openly rounded at about 90 degrees. A short pale yellowish brown triangular shaped spine at base of each operculum. Underside of abdomen brown (paler in female) with pale golden pubescence near and on lateral margins of sternites.

It is likely that the song of this cicada is loud and penetrating like that of *M. angularis*, and that it, too, inhabits tall trees.

Cotypes: 1♂ Aust. Mus.; 2♀♀ S.A. Mus.

Macrotristria hillieri Distant.

Macrotristria hillieri Distant, 1907, Ann. Mag. nat. Hist. (7) 20: 413.
Macrotristria hillieri Ashton, 1914, Trans. roy. Soc. S. Aust., 38: 347.
Macrotristria hillieri Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 102.

This is a species of the drier interior and coastal parts of Western Australia where the rainfall probably does not exceed 20 inches. It extends over a wide area though it appears to be rather local in habitat. The majority of the specimens examined have come from the region of Alice Springs–Hermannsburg area; other localities include Mildura, Victoria; Carnarvon, W.A.; Roeburne, W.A.; Charlotte Waters, N.T.; and Flinders Ranges, S.A. It's general colouration is dark chocolate brown with a few fine yellow markings on the head and thorax; in general appearance and size it resembles another dry country species, *M. occidentalis* Dist. Body length, male, average (14) 32·3 mm., + 2·2 mm., —2·3 mm.; female (9) 32·3 mm. + 4·2 mm., —1·8 mm. Head blackish or dark chocolate brown, longitudinally striate, considerably wider than pronotum; a narrow yellow frontal band from eyes to frons which is keeled

and narrowly marked yellow at the vertical angle; a small yellow median depressed spot posterior to ocelli, and a smaller similar spot alongside each lateral ocellus; posterior margin with an irregular yellowish marking on either side of mid-line; frons dark brownish black with transverse ridges clearly defined and interstitial grooves silvery pubescent; front below vertical angle almost planate; transverse ridges normally 13–14 in number. Ocelli not quite equidistant, dark golden or pale orange vitreous; anterior well in front of line of eyes. Genae black, densely silvery pubescent, margins yellow, carinate. Antennae with two basal segments dark brownish, others (3) yellowish. Clypeus dark brownish black; silvery pubescent; keeled medianally, slightly more than half length of frons; labrum yellowish, grooved medianally; labium brownish black, grooved as labrum, reaching anterior margin of posterior coxae. Eyes brownish opalescent.

Thorax, average width 13·8 mm.; brownish black or dark chocolate brown, with yellow and lighter brown markings. Pronotum with three sharply cut sulci on either side of midline, raised areas between openly sculptured, depressions with silvery pubescence; an elongate narrow, median yellow marking and lighter brown obscure patches dorso—laterally; posterior marginal band fairly wide, transversely striate; a small yellow median spot on its anterior margin; posterior margin widely lined yellow which extends round laterally to near margins where it widens; anterior portion of lateral margin yellow, slightly lobed. Mesonotum slightly paler than pronotum, almost smooth; depressed areas silvery pubescent; lateral margin yellow, carinate. Cruciform elevation well developed, dark yellow with dark brown central marking, anterior arms longer than posterior. Metanotum dark brownish black; finely lined yellow dorsolaterally. Wings, anterior, average length, male, 44·4 mm., width, 14·1 mm.; female 44·1 mm., 14·2 mm.; clear vitreous with veins C, R, M, M1 (to stigma beyond first branch) M3 and CU1 (to first forks) yellow; SC, ambient, and remaining portions of all other veins dark brown; cross veins from R3 to CU1a infuscated translucent brown. Posterior, average length, male, 26·6 mm., width, 12·5 mm., female, 25·9 mm., 13·0 mm., clear vitreous with veins RS, M, (to first branch) ambient, 2A and 3A dark brown, remainder yellow; 2A and 3A margined translucent fuscous. Legs dark brown, finely silvery pubescent, marked with yellow at joints, anterior femora, and tarsi. Anterior femora with 2 large and 1 very small spines, anterior almost at half-way, second three quarters, third distally at base of second. Posterior tibiae with five spines, two exteriorly, three interiorly; the first exterior just before half-way, second near distal; first interior at half-way, second at three-quarters, third just beyond second exterior. Underside of thorax brown, thickly silvery pubescent. Abdomen dark brown or chocolate, last two segments floculent whitish, other segments finely golden pubescent. Opercula yellowish brown, whitely pubescent, fairly widely separated; their external angles obtuse, internal sharply rounded. Underside of abdomen brownish, junctions of tergites and sternites with white floculence; basal margins of segments widely yellowish, silvery pubescent.

Type: British Museum.

Macrotristria occidentalis Distant.

Macrotristria occidentalis Distant, 1912, Ann. Mag. nat. Hist. (8) 10: 438.
Macrotristria occidentalis Ashton, 1914, Trans. roy. Soc. S.Aust., 38: 348.
Macrotristria occidentalis Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 102.

This dry country Western Australian species is apparently not well represented in collections; in all I have been able to examine only five males

and two females. The following description of the male has been made from a specimen in the collection of the Western Australian Museum and which has been labelled accordingly. It is from Waddi Forest and bears the indentification number 41–249 16. All the specimens have been collected in an area bounded by Mullewa (near Geraldton) in the north, Mt. Jackson in the south, and Dedari in the east., Although I have examined much cicada material from the north-west and centre, no specimen of *M. occidentalis* has been included from those areas. Unfortunately none of the specimens bears a date of capture, but it is safe to assume that it is a late spring and early summer species. In Distant's original description (1912 (*b*)) he adds the following footnote: "I have only seen the female sex of this species which may be placed near *M. hillieri* Distant. Habitat: Southern Cross, W.A., H. Brown (Brit. Mus.). Body length male, average (5) 28·0 mm., + 2·0 mm., — 2·0 mm.; female, average (2) 27·7 mm. + 0·8 mm. — 0·7 mm. Head, including frons, chestnut brown; openly ridged longitudinally; a yellow frontal band, widest near eyes, to frons and extending round posterior margin of the latter as a fine line, and an obscure yellow patch near each eye bordering posterior margin. An open median groove from anterior ocellus to posterior margin. Ocelli pinkish brown; vitreous, the distance between anterior and each posterior half that between the two latter; anterior in line with front margin of eyes. Frons light chestnut brown, prominently rounded; openly grooved at vertical angle; transverse ridges well defined, 14–16 in number, interstitial grooves silvery pubescent. Genae yellowish brown, evenly silvery pubescent; external margins strongly carinate. Antennae chestnut brown; clypeus chestnut brown, silvery pubescent, sharply keeled; labrum yellowish brown, grooved medianally, sides planate and shining; labium yellowish, tipped brownish, reaching anterior margin of posterior coxae. Eyes opalescent brown.

Thorax, average width, male, 11·8 mm., female 11·5 mm.; chestnut brown, almost devoid of markings. Pronotum sculptured; three deep sulci on either side of mid-line, raised areas between first and second and outer sulcus slightly paler in colour; posterior marginal band fairly wide, yellowish, bordered anteriorly chestnut brown. Lateral margin of pronotum yellow anteriorly and slightly lobed. Mesonotum light brown with darker brown median patch from anterior margin narrowing to cruciform elevation; in this patch a fine yellow line on either side of median curving inwards and reaching mid dorsal. Upper lateral margin thickly silvery pubescent; lower, yellow, carinate. Cruciform elevation yellowish brown, anterior arms longer than posterior. Metanotum chestnut brown, lined yellow dorsally. Wings, anterior, male, average length, 39·4 mm., width, 13·3 mm., female, 39·25 mm., 12·75 mm.; clear vitreous; costal, Sc, R, and CU2 yellow, all others chestnut brown. Cross veins from R2 to CU1a bordered translucent brown, also terminal branches of veins R2 to CU1a. Posterior, male, average length, 23·3 mm., width, 11·3 mm.; female, 22·7 mm., 10·2 mm.; clear vitreous; veins RS and M to first branches, 3A and ambient, brown, others yellowish; 2A and 3A widely margined translucent brownish white. Legs pale brown; coxae and femora finely silvery pubescent; anterior femora with two large and one very small spines, anterior just before half-way, second almost at distal, third and smallest at base of second. Posterior tibiae with five spines, two exteriorly, three interiorly; first exterior almost at half-way, second mid-way between second and third interior; first interior opposite first exterior, second at two-thirds, third close to distal. Underside of thorax light brown, silvery pubescent. Abdomen brown with wide transverse dark brown median area on each segment; silvery pubescent along intersegmental margins. Opercula not very large, yellowish, widely dark brown at base; interior

margins fairly widely separated, external angles openly and evenly rounded, internal evenly rounded. Underside of abdomen chestnut brown, a wide transverse yellowish median area on each segment; thickly silvery pubescent near and at junctions of tergites and sternites.

Type: Brit. Mus.

Macrotristria nanda sp. nov.

This large and dark coloured species resembles the female of *M. angularis* (Germar) in size and shape. It is labelled Murchison River district, N. W. Australia, February, 1902. Unfortunately I have not been able to examine a male of this fine species. It is named *nanda* after the aborignal tribe that inhabited the area near the mouth of the Murchison river. Body length, 42·0 mm. Head equal in width to pronotum; openly striate longitudinally; blackish brown (including frons), a transverse narrow frontal reddish yellow band from either side of frons to half-way to eyes, a small reddish brown patch adjoining posterior margin near each eye; vertex of frons with a sharp groove, another open groove from anterior ocellus to posterior margin; ocelli reddish vitreous, closely grouped, distance between two lateral almost twice that between anterior and each lateral. Frons prominent, medianally grooved from near vertical angle to clypeus. Transverse ridges fairly clearly defined; twelve in number; sparsely golden pubescent. Genae black, golden pubescent; exterior margins widely reddish brown; carinate. Clypeus black, finely golden pubescent; sharply keeled medianally, lateral margins lined reddish brown. Labrum reddish brown, grooved medianally, sides planate; labium (not entire in specimen) dark reddish brown, reaching anterior margin of posterior coxae. Eyes opalescent dark reddish brown. Thorax, width, 19 mm., blackish brown, pronotum scupltured; three sulci on either side of midline; a median longitudinal narrow reddish brown marking from anterior almost to posterior margin; depressed areas slightly golden pubescent. Transverse lateral band fairly wide, transversely striate; posterior margin narrowly yellowish brown, lateral margin lobed anteriorly. Mesonotum blackish brown very finely punctate; an inwardly curving very fine groove on either side of midline from anterior margin to half-way; exterior to this on each side, a slightly paler dorso-lateral patch; upper lateral margin reddish brown anteriorly. Cruciform elevation fairly strongly developed, anterior arms blackish brown, apex and posterior arms reddish brown; depression golden pubescent; area between each posterior and anterior arm transversely striate. Lower margin of mesonotum reddish brown, carinate. Metanotum reddish brown. Wings, anterior length, 56·0 mm., width 20·0 mm.; clear vitreous with costal, terminal branches of other veins, and ambient dark brown; subcostal, radial and other veins to ends of main cells, and basal cell, yellowish brown, external veins of basal cell, black. Posterior, length, 33·0 mm., width 15·0 mm.; clear vitreous with ambient, veins 2A and 3A dark brown, others yellowish brown; 3A widely margined translucent pinkish brown. Legs blackish brown, very sparsely golden pubescent. Anterior femora with two large spines and two minute tuberculate spines; anterior spine not quite at half-way, second at three-quarters; the first of the two minute tuberculate spines near base of second large spine, the second half-way to distal. Posterior femora with six spines, two exteriorly, four interiorly; first exterior at half-way, second three-quarters; first interior opposite first exterior, second close to first, third almost opposite second exterior, fourth midway to distal. Underside of thorax blackish brown. Abdomen uniformly blackish brown, fairly golden pubescent along inter-segmental margin. Pseudopercula (♀) blackish brown

with exterior margins yellowish brown; basal spines dark brownish black tipped reddish brown, situated at base of posterior coxae. Underside of abdomen blackish brown; very lightly golden pubescent.

Type: S.A. Mus. (Murchison River district, N.W. Australia, February, 1902.)

Macrotristria kabikabia sp. nov.

This interesting specimen was included amongst cicada material kindly loaned to me for study from the University of Queensland. At first glance it resembled a diminutive female of *M. angularis* (Germar), but closer inspection revealed it as being quite distinct from any other species of *Macrotristria* I have studied. It is labelled " Yabba—6.12.47, A. C. Arvier ", and confirmation of this data from Dr. T. Woodward, Department of Entomology, University of Queensland, reveals that it should read " Yabba Creek " which embraces an area near Imbil in the Gympie district. As the specimen is quite distinct from any other known *Macrotristria*, it is named *M. kabikabia* after the tribal name (Kabi Kabi) of aborigines which lived in that area. Body length, 37·5 mm.; head considerably wider than pronotum, smooth; reddish brown, blackish on vertex and posterior to frons; behind each eye, a creamy yellow spot in the black area on each side of anterior ocellus; exterior to each lateral ocellus two small similar spots, and a medium creamy yellow groove from anterior ocellus to posterior margin; on each side near the posterior margin another larger creamy yellow patch. Area behind eyes and extending across posterior margin silvery pubescent. Ocelli fairly closely grouped; pinkish vitreous; anterior in front of line of anterior margin of eyes. Frons reddish brown, slightly darker on ridges and median groove; transverse ridges twelve in number, clearly defined; interstitial grooves silvery pubescent near lateral margins excepting middle one where the pubescence extends half-way across front. Genae black, almost completely obscured with silvery white pubescence; external margins pale yellow, carinate; clypeus brownish black, sharply keeled, silvery pubescent, not quite half as long as frons; labrum brown, shining; paler near clypeus, grooved medianally, sides planate; labium black, grooved as labrum, extending just beyond anterior margin of posterior coxae. Antennae (last two joints missing) dark brownish black. Eyes opalescent reddish brown. *Thorax*, width 14·0 mm. Pronotum smooth, reddish brown anteriorly, yellowish brown posteriorly; three sulci on either side of midline, black in depressions and black spots in raised areas between sulci; a medium dorsal black marking from anterior to posterior margins enclosing an elongate yellowish linear marking; posterior marginal band wide, yellowish, transversely striate; blackish along anterior border, the black extending as a band across to the posterior border near lateral margins. Lateral margins of pronotum blackish, carinate, weakly lobed anteriorly. Mesonotum smooth, yellowish brown; on either side of midline a triangular black marking from anterior margin almost to half-way; exterior to each of these another larger triangular dorso-lateral black marking from anterior margin to anterior arms of cruciform elevation; the latter weakly developed, reddish brown; anterior arms longer than posterior; anterior depression black with a yellowish spot; all these depressions silvery pubescent. Upper lateral margin of mesonotum blackish, silvery pubescent; lower as upper. Metanotum brownish black. Wings, anterior, length, 48·0 mm., width, 14·5 mm.; clear vitreous with all veins brown excepting subcostal and radial which are yellow. Cross veins from R3 — R4 + 5, R4 + 5 — M1, M2, — M3, M4 — CU1a, and terminal arms of veins R3 to CU1a bordered translucent brown; basal cell dark brown; membrane from 1A to body pinkish. Posterior, length, 26·0 mm., width, 12·0 mm.; clear vitreous with

veins yellowish, ambient pale brown, basal third of RS, M, CU1, CU2 and entire length of 2A and 3A edged translucent brown, the two latter margined pinkish. Legs dark brown, finely pubescent; anterior femora with two large and one very small spines, anterior just before half-way, second three-quarters, third and smallest nearer base of second than distal. Posterior tibiae with five spines, two externally, three internally; first exterior about one-third, second three-quarters; first interior half-way, second two-thirds, third close to distal. Underside of thorax yellowish; silvery pubescent. Abdomen dark brownish black; finely golden pubescent along anterior margins of segments. Underside dark brownish black; segments 2 6 inclusive lighter brown mid-ventrally, lateral parts of segments and junctions of tergites and sternites densely silvery pubescent.

Type: Queensland Museum. (Yabba, 6.12.47, A. C. Arvier.)

Macrotristria thophoides Ashton.

Macrotristria thophoides Ashton, 1914, Proc roy. Soc. Vict. (N.S.) 27: 13, pl. 2, fig. 1, a.

Macrotristria thophoides Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 99.

This large and interesting West Australian species bears a superficial resemblance to *M. hieroglyphica* (G. & F.) from which it may easily be separated by the infuscation bordering four of the cross veins in the anterior wings, its larger size, and the more reddish colour of the head and frons. I have been privileged to examine the type female from the Australian Museum collection and the single male in the S.A. Museum collection. Description of the male was made from this specimen which has been labelled accordingly. Neither of these specimens bears a date, they were collected at Norseman and Cue, Western Australia, respectively, by the late H. W. Brown. No data seems to be available regarding the habits or time of appearance of this cicada. Body length, male, 38·0 mm., female, 41·0 mm. Head slightly wider that pronotum, smooth; reddish brown (including frons) finely silvery pubescent in depressions; an angular median groove from anterior ocellus to posterior margin, and exterior to each lateral ocellus a weak sulcus. Ocelli pinkish brown vitreous, closely grouped, not equidistant; anterior ocellus in line with front margin of eyes. Frons reddish brown, prominent, an extremely shallow and open groove from vertical angle almost to clypeus; transverse ridges 15 in number, clearly defined; interstitial grooves silvery pubescent towards and at lateral margins of frons. Genae reddish brown, densely silvery pubescent; exterior margins sharply carinate. Antennae reddish brown. Clypeus reddish brown; sharply keeled, sides planate; silvery pubescent. Labrum reddish brown in front, grooved medianally; sides yellowish brown, planate, silvery pubescent. Labium pale yellowish brown, grooved as labrum; reaching middle of posterior coxae. Eyes opalescent reddish brown. Thorax, width, male 15·0 mm., female, 17·5 mm.; pronotum dark yellowish brown, finely sculptured on areas between sulci; three sulci on either side of midline, blackish in grooves and silvery pubescent; a narrow elongate median area enclosed with a fine brownish line which expands into a small patch at anterior and posterior margins; posterior marginal band wide, yellowish brown, finely transversely striate; lateral margins of pronotum yellowish brown, black anteriorly. Mesonotum smooth, brownish black with faint reddish suffusion; two yellowish brown markings on either side of midline, one near mid dorsal, other adjoining upper lateral margin. Cruciform elevation well developed, yellowish brown, silvery pubescent in depressions. Upper lateral margin of mesonotum brownish black, silvery pubescent; lower dark reddish

brown, carinate. Metanotum dark reddish brown. Wings, anterior, male, length, 45·0 mm., width, 16·0 mm.; female, 50·0 mm., 18·0 mm.; clear vitreous with veins dark brown excepting costal and subcostal which are pale yellowish brown. Cross veins between R3, R4 + 5, — M1, — M2, — M3, — M4, — CU1a margined translucent brown; CU1–CU2—faintly and narrowly so; terminal branches of veins from R4 + 5 to CU1a each with a small translucent brown spot near ambient vein. Basal cell brownish. Posterior male, length, 29·0 mm., width, 15·0 mm.; female 31·0 mm., 15·0 mm.; clear vitreous; veins yellowish brown; M, CU2 and 3A, margined translucent brown also margin of cell 3A. Legs dark reddish brown; anterior femora with two large spines and a small tubercle; anterior spine at half-way, second just beyond three-quarters, tubercle at base of second spine. Posterior tibiae with five spines; two exteriorly, three interiorly; first exterior half-way, second midway between second and third interior, first interior opposite first exterior, second just beyond three-quarters, third almost at distal. Underside of thorax dark reddish brown; densely silvery pubescent. Abdomen dark brownish black, first three segments silvery pubescent mid-dorsally, penultimate segment and posterior margin of one before it, silvery pubescent, other segments finely golden pubescent. Opercula dark reddish brown; finely silvery pubescent, interior margin of left (seen from ventral) slightly overlapping right; margins recurved, external angles openly rounded, internal acutely. Basal spine very short, tipped yellowish. Underside of abdomen reddish brown; silvery pubescent, densely so at and near junctions of tergites and sternites.

Type: (♀) Aust. Museum.

Macrotristria hieroglyphica (Goding and Froggatt).

Cicada hieroglyphica Goding and Froggatt, 1904, Proc. Linn. Soc. N.S.W. 29: 581.
Rihana hieroglyphica Distant, 1906, "Syn. Cat. Hom." 1: 38.
Cicada hieroglyphicalis Kirkaldy, 1910, Canad. Ent. 41: 391.
Macrotristria hieroglyphica Ashton, 1914, Trans. roy. Soc. S. Aust., 38: 347.

This is an apparently rare and local species found in the north-west of Western Australia. It is a large and strikingly marked insect, the patern of markings on the thorax resembling hieroglyphics. As far as I am aware no recorded specimens have been taken for many years. The four specimens (1 ♂ 3 ♀♀) I have been able to examine were collected between the years 1887 and 1893 and these include the types from the collection of the Macleay Museum, Sydney. No data relating to habits or actual dates of appearance seems to be available.

Body length, male, 34·5 mm., female, 36·0 mm. Head equal in width to pronotum, smooth; dark reddish brown (including frons) faintly silvery pubescent in depressions; a weak sulcus exterior to ocelli on either side and on median groove from anterior ocellus to posterior margin. A greenish brown wide frontal band across head between eyes but not embracing vertex of frons; another suffused yellowish brown marking from each eye along posterior margin of head almost to sulcus near ocelli; the latter closely grouped; dark golden vitreous, not equidistant; anterior ocellus in line with front margin of eyes. Frons dark reddish brown with a wide yellowish brown marking on front from near vertical angle almost to clypeus. Transverse ridges clearly defined; 10 in number; interstitial grooves shallow, silvery pubescent only near junction of genae and frons. Genae reddish brown; densely silvery pubescent, external margins sharply carinate. Antennae reddish brown. Clypeus yellowish brown;

finely keeled, sides silvery pubescent. Labrum brownish; grooved medianally, sides planate; labium dark reddish brown, keeled as labrum, reaching posterior margins of hind coxae. Eyes opalescent reddish brown. Thorax, width, male, 14·5 mm., female, 14·5 mm., smooth; pronotum reddish brown with three sulci on either side of mid line, raised areas on each side between first and second sulcus and part of first yellowish; transverse marginal band wide; transversly striate, anterior margin reddish brown; lateral margins of pronotum reddish brown; carinate, slightly lobed anteriorly. Mesonotum smooth; yellowish brown, with a triangular median reddish brown marking from anterior margin to cruciform elevation; on either side dorso-laterally another triangular reddish brown marking with the apex meeting the upper lateral margin at extremity of anterior arms of cruciform elevation; the latter dark reddish brown, depressions silvery pubescent; upper lateral margin of mesonotum reddish brown, silvery pubescent, slightly carinate; lower margin reddish brown, finely and sparsely silvery pubescent, carinate. Metanotum dark reddish brown. Wings, anterior, male, length, 41·5 mm., width, 15·5 mm.; female, 43·5 mm., width, 14·0 mm.; clear vitreous with veins M, M1, M2, M3, M4, CU1a and cross veins from CU1 to CU2 dark brown; costal, sub-costal, radial, and CU2 yellowish. A very narrow infuscation bordering cross veins from R3 to M3, and on terminal branches near ambient vein; a faint infuscated spot on R4 + 5, M1, M2, M3, M4, and CU1a. Basal cell dark brown, semi-translucent. Posterior length, male, 25·0 mm., width, 13·5 mm.; female 26·0 mm.; 12·5 mm.; clear vitreous, veins yellowish excepting ambient 2A and 3A which are brown. Legs, reddish brown, coxae lighter; anterior femora with two large and a minute spine, anterior at half-way, second near distal, minute spine at base of second nearer distal. Posterior tibiae with five spines, two externally, three internally; first exterior half-way, second three-quarters; first interior not quite half-way, second midway between first and second interior; third almost at distal. Unterside of thorax dark reddish brown, silvery pubescent. Abdomen dark reddish brown sparsely palely golden pubescent along intersegmental margin. Opercula dark reddish brown, short silvery pubescent; external angles very openly obtuse, internal acutely rounded; left (seen from ventral) slightly overlapping right; basal spine in centre of posterior margin; lined yellowish. Underside of abdomen dark reddish brown; silvery pubescent mainly at and near junctions of tergites and sternites.

Types: Macleay Museum.

Macrotristria godingi Distant.

Macrotristria godingi Distant, 1907, Ann. Mag. nat. Hist. (7) 20: 412.
Macrotristria godingi Distant, 1912, "Gen. Ins." 142: 26, pl. 3, figs. 23a, b, c.
Macrotristria godingi Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 99.

A large and beautiful North Queensland species which appears to be confined to the coastal strip from Townsville in the south to about Mt. Molloy in the north. I have been able to examine altogether ten specimens (4 ♂♂ 6 ♀♀) and the localities include on label data, Mt. Molloy 1♀, Sellheim, N.Q. 2♂♂ 1♀, Kuranda, N.Q. 2 ♂♂ 1 ♀, Cairns N.Q., 1 ♀, and one female labelled "Hamilton Q." which is regarded doubtfully as correct. It is a summer species occurring mainly during January. I have no information regarding its habits. Body length, male, average (4), 38·8 mm., + 1·2 mm., —1·3 mm., female, average (6) 38·2 mm., + 1·3 mm., —1·7 mm. Head wider than pronotum, smooth; yellowish brown (excepting frons which is reddish brown) with interrupted fairly wide black fascia surrounding ocelli; a narrow black margin bordering eyes;

Macrotristria nigronervosa Distant.

Macrotristria nigronervosa Distant, 1904, Ann. Mag. nat. Hist. (7) 14: 329.

Macrotristria nigronervosa Distant, 1906, "Syn. Cat. Hom." 1: 31.

Macrotristria nigronervosa Ashton, 1921. Proc. roy. Soc. Vict. (N.S.) 33: 100.

I have not been able to see a specimen of this species, but am greatly indebted to Mr. R. J. Izzard of the British Museum (Natural History) for an excellent life sized photograph and detailed description of the Type. Though smaller, this cicada bears a strong superficial resemblance to *M. godingi* Distant, but lacks the black markings present on the pro and mesonotum of *godingi*. In his original description, Distant, 1904, Ann. Mag. nat. Hist. (7) 14: 329 states, "Allied to *M. intersecta* Walk. from which it differs by the more prominent face, spotted tegmina, different colour markings, &c. "Its habitat is given as North Queensland." I am able to give a description of the female only.

Body length, 41·5 mm., Head, equal in width to pronotum, cinnamon brown (may be green in life), smooth, ocelli surrounded by narrow black fascia. A median groove from anterior ocellus to posterior margin, ocelli vitreous amber, grouped rather closely, almost equidistant. Frons prominent, reddish brown with faint central black marking on vertex, transverse ridges eight in number, interstitial grooves finely silvery pubescent. Genae blackish, densely white pubescent. Antennae, dark brownish. Clypeus dark brown, labrum and labium dark brown, the latter reaching posterior coxae. Eyes dark opalescent brown, inner margin from front to half-way lined black. Thorax, width 14·0 mm. Pronotum cinnamon brown with three sulci on either side of mid-line, a small dark central spot adjoining posterior marginal band, the latter wide, yellow and finely striate transversely. Lateral margins unicolorous with pronotum and lobed anteriorly. Mesonotum cinnamon brown, smooth, anterior margin bordered black, on either side of midline a V shaped black marking extending to one-third. Cruciform elevation well developed, cinnamon brown, apex wide transversely, anterior arms slightly longer. Lateral margin of pronotum cinnamon, silvery pubescent. Metanotum blackish with sparse silvery pubescence. Wings, anterior, 44·0 mm., width, 14·0 mm., clear vitreous with veins black, excepting Costal and subcostal which are yellowish, and Radial which is yellowish brown. Cross veins between R3, R4 + 5, M, margined translucent dark brown, and a small similarly coloured spot on the terminal branches (near ambient vein) of R4 + 5, M1, M2, M3, and M4. Basal cell translucent yellowish brown. Posterior, length, 23·0 mm., width, 12·0 mm.; veins dark brownish black excepting M, CU1a and 1A which are lighter in colour, 2A and 3A bordered translucent brown. Legs with femora cinnamon brown, tibiae and tarsi darker brown. Anterior femora with two spines, the posterior, black, near middle, apical near junction of tibia. Posterior tibiae probably with five spines (apparently some missing from specimen), information given reveals two only, brown, one at middle, other near distal. Abdomen black, silvery pubescent, brown at intersegmental margins, broadly so in penultimate segment and preceding one.

Type: British Museum. *Label data:* North Queensland, Dr. Heath.

The following note is kindly supplied by Mr. Izzard. "Closely allied to *M. intersecta* Walk, and *M. sylvanella* (G. & F.) but somewhat larger in size."

vertex of frons with an oval shaped yellowish brown patch in which is a suffused reddish median longitudinal marking; a narrow sharp median groove from anterior ocellus to posterior margin. Ocelli bright red, vitreous; very closely grouped, not quite equidistant, anterior ocellus in line with front margin of eyes. Frons prominent, openly rounded, dark reddish brown faintly yellowish at junction with clypeus; front planate towards clypeus and with a faint median groove from about half-way to latter. Transverse ridges clearly defined 12–14 in number; interstitial grooves not pubescent. Clypeus black, not sharply keeled, half length of frons; medianally yellowish brown, sides planate, silvery pubescent. Labrum yellowish, grooved medianally; labium black, sides of upper portion yellowish, grooved as labrum, reaching anterior margin of posterior coxae. Genae black, silvery pubescent; exterior margins yellowish, strongly carinate. Antennae dark brownish black. Thorax, width, male average (4), 16·0 mm., female, average (6) 15·9 mm.; yellowish (may be greenish in life) with black markings. Pronotum smooth with three deep sulci on either side of mid line; irregularly lined black, a median longitudinal rectangular black marking almost from anterior to posterior margin enclosing a wide yellowish brown line; posterior marginal band wide, concolorous with pronotum, finely striate transversely; lateral margins of pronotum anteriorly lobed. Mesonotum slightly paler than pronotum; on either side of midline a black triangular marking from anterior margin to about one-third; from anterior arms of cruciform elevation a black marking extending forwards on each side almost or completely coalescing with the median triangular black markings; dorso-laterally on each side a larger black marking from anterior margin to three-quarters; cruciform elevation yellowish, fairly strongly developed, posterior arms slightly longer than anterior; depressed areas slightly silvery pubescent; upper lateral margins lined black, lower margins yellowish and strongly carinate. Mesonotum yellowish brown. Wings, anterior, male, average length (4) 52·0 mm., width, 18·00 mm.; female, average (6), 50·7 mm., width, 16·6 mm.; clear vitreous with all veins, excepting Costal, Subcostal, Radial and 1A which are yellow, (may be green in life), dark brown; terminals of R4 + 5, M1, M2, M3, M4 and CU1a with a faint translucent brown spot near junction with ambient vein. Upper portion of basal cell, yellowish. Posterior, male, length, average (4) 29·0 mm., width 15·3 mm.; female, average (6) 27·3 mm., 14·8 mm.; clear vitreous; veins Rs. M and branches of these, 2A, 3A, and ambient, dark brown, others yellow; 2A and 3A bordered yellowish white, widest basaly. Legs yellowish brown; coxae and femora marked with dark brown, anterior and middle tibiae and tarsi dark brown, posterior yellowish brown. Anterior femora with two large and one small spines, anterior just before half-way, second three-quarters, third and smallest distally near base of second. Posterior tibiae with five spines, two exteriorly three interiorly; first exterior half-way, second just beyond three-quarters; first interior a little anterior to first exterior, second a little more than half-way between two exteriors, third closer to distal than second exterior. Underside of thorax black, silvery pubescent. Opercula usually black, sometimes with a blackish yellow area near exterior margins; right or left may overlap at internal angles; external angles widely obtuse, internal rather acutely rounded; basal spine small, edged yellow. Abdomen dull blackish or blackish brown; very sparsely and finely pale golden pubescent; anterior margin of second segment, and posterior margin of segments (normally) 4–9 yellow on posterior margins, the width of the yellow increasing on each segment towards apex. Underside of abdomen shining blackish, posterior margins of segments yellowish, finely silvery pubescent near and at junctions of tergites and sternites.

Type: Brit. Mus.

Macrotristria doddi Ashton.

Macrotristria doddi Ashton, 1912, Proc. roy. Soc. Vict. 24:
Macrotristria doddi Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 101.

This is an apparently rare far northern species described as recently as 1912 from three male specimens collected by the late F. P. Dodd at Kuranda, North Queensland. Ashton states, locality doubtful, either North Queensland or Northern Territory. I have been privileged to examine the Type (Australian Museum) and one one other male only from the collection of Mr. F. E. Wilson (Victoria). Although no date is given the locality is Adelaide River, N.T. (H. W. Brown). The female is apparently uknown. In general appearance it resembles *Macrotristria occidentalis* Distant, but is slightly larger, the front of the head is less prominent, and the general body colour is darker and more patterned with yellowish brown. The infuscation bordering the cross veins in the anterior wings is much less pronounced. It is probably a summer species.

Body length, male, average (2 specimens) 32·5 mm. Head smooth, slightly wider than pronotum, yellowish brown with a black transverse band below eyes to frons, ocelli reddish orange vitreous, enclosed within a rectangular black central patch which has a line or extension running across head towards each eye and extends round posterior margin as a black line. A very sharp fine median groove runs from anterior ocellus to posterior margin. Frons dark reddish brown with a yellowish patch on vertex which extends and narrows round vertical angle. Transverse ridges well defined, 9–10 in number. Interstitial grooves golden pubescent near outer ends. Width between posterior ocelli almost double that between anterior and each lateral ocellus, anterior in line with front margin of eyes. Genae yellowish, densely golden pubescent, external margins carinate. Antennae (2 basal segments only, others absent from specimens) dark brown. Clypeus dark brownish red, golden pubescent, half length of frons; labrum yellow, finely grooved medianally, sides planate, brownish yellow; labium yellowish, posterior third dark brown, finely grooved as labrum, reaching posterior margins of hind coxae. Eyes opalescent yellowish brown. Thorax, av. width, 12·5 mm., reddish brown with black and yellowish brown markings. Pronotum with three open sulci on either side of midline, raised areas between finely sculptured, a yellowish brown (probably suffused greenish in life) central marking widest at anterior margin, narrowing to posterior margin; posterior marginal band fairly wide, yellowish, its posterior margin black. Lateral margin of pronotum with anterior half yellow, lobed anteriorly, posterior half-brownish black. Mensonotum smooth, yellowish brown, anterior margin black, a black central marking enclosing a small triangular yellowish brown area, this black marking bordered yellowish on either side and contiguous with anterior arms of cruciform elevation; a triangular reddish brown marking dorso-laterally on each side. Cruciform elevation fairly well developed, yellowish brown, pale golden pubescent in depressions, lateral margin of mesonotum reddish brown, pale golden pubescent. Metanotum brownish black dorsally, becoming yellowish brown laterally. Wings, anterior, male length 41·5 mm., width 12·5 mm., clear vitreous with all veins brown, 2A and 3A margined translucent brown. Legs chestnut brown, joints and anterior coxae paler. Anterior femora with two large and one very small spines, anterior at half-way, second about three-quarters, third and smallest just beyond base of second. Posterior tibiae with five spines, three interiorly, two exteriorly; first exterior just beyond half-way, second beyond three-quarters, first interior before half-way, second at two-thirds, third midway between second of exterior and distal. Underside of thorax yellowish, finely silvery pubescent. Abdomen dark

brownish black, anterior margin of first segment reddish brown, sides of all segments silvery pubescent. Opercula yellow, finely silvery pubescent, external angles openly rounded, internal acutely; margin carinate, left (seen from ventral) slightly overlapping right at interior margin. Underside of abdomen yellowish brown excepting last two or three segments which are dark brown; pale golden pubescent densest at junction of tergites and sternites.

Type: Aust. Mus.

Macrotristria sylvara (Distant).

Cicada sylvara Distant, 1901, Trans. ent. Soc. Lond.: 591, pl. 16, figs. 1a, b.
Cicada sylvana Goding and Froggatt, 1904, Proc. Linn. Soc. N.S.W. 29: 580.
Macrotristria sylvara Distant, 1906, "Syn. Cat. Hom." 1: 31.
Macrotristria sylvara Ashton, 1914, Trans. roy. Soc. S.Aust. 38: 347.
Macrotristria sylvara Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 100.

One of the largest species of the genus which is found from the Cairns district to Cape York in Northern Australia and some of the Torres Straits islands. I have little data regarding its habits, excepting that it is a mid-summer species (December–February) and frequents shrubs locally known as "Horse bush" and "White Currant bush". The series of specimens I have before me are from Cairns, Kuranda, Barron River (Kamerunga Crossing), Moa Island (Torres Straits), Stewart River, and Coen district, Cape York.

Body length, male, average (10), 39·8 mm., + 2·2 mm., —2·3 mm.; female, average, (10), 37·5 mm., + 2·5 mm., —5·0 mm. Head considerably wider than pronotum, smooth, green, posterior margin of vertex of frons finely lined black, front of orbits of eyes to vertex lined black, at the vertex the black leaves each orbit and extends a little distance towards posterior margin of head. Ocelli large, not quite equidistant, very closely grouped, yellowish green vitreous, surrounded by black fascia which tend to coalesce, and sometimes a small transversely elongate minute spot exterior to each lateral ocellus; a sharply defined median groove from anterior ocellus to posterior margin. Frons green on vertex, middle front from vertical angle to clypeus black, sides tinged brownish, transverse ridges rather regular, fairly well defined, 12–14 in number, interstitial grooves not pubescent; genae black, silvery pubescent, exterior margins pale yellowish green, sharply carinate. Clypeus black, half length of frons, silvery pubescent excepting on keel which has a brownish longitudinal marking about the middle; labrum yellowish brown, grooved medianally, sides planate; labium dark brown near labrum quickly merging into black, grooved as labrum, reaching just beyond anterior margins of posterior coxae. Antennae dark brownish black; eyes opalescent greenish yellow.

Thorax, width, male, average (10), 15·7 mm., female, average (10), 15·7 mm. Pronotum green, smooth, three strongly developed deep sulci on either side of midline, anterior margin slightly carinate, posterior marginal band wide, rather evenly striate transversely, lateral margin of pronotum carinate, lobed anteriorly. Mesonotum green, smooth, on either side of midline fairly close to it, a black inwardly curving depressed line to about half-way, base of anterior depression of cruciform elevation black, the latter yellowish green, fairly well developed, apex broad transversely, posterior arms slightly longer than anterior, depressions silvery pubescent, upper lateral margin of mesonotum silvery pubescent, lower yellowish, carinate, silvery pubescent. Metanotum black.

Wings, anterior, male, average length (10), 57·8 mm., width, 17·0 mm., female, average (10), 50·9 mm., 16·6 mm. Clear vitreous, veins brown excepting costal, sub-costal and radial to branch with R.; cross veins between

R3 and R4 + 5, — M1 and M2–M3 faintly and narrowly margined translucent brown, terminals near ambient vein of R4 + 5, M1, M2, M3, M4 and CU1a with a brown infuscate spot, basal cell with upper half green. Posterior, male, average length (10), 27·9 mm., width, 14·5 mm.; female, average (10), 27·3 mm., 14·2 mm. Clear vitreous with all veins brown excepting M to first fork and 1A which are yellowish green; 2A and 3A margined dark translucent brown. Legs with coxae and femora green or greenish yellow with brown markings, tibia and tarsi dark brown. Anterior femora with two large and one small spines anterior just before half-way, second three-quarters, third and smallest distally at base of second. Posterior tibiae with five spines, two exteriorly, three interiorly; first exterior beyond half-way, second beyond three-quarters; first interior half-way, second just anterior to second exterior; third midway between the latter and distal. Underside of thorax greenish yellow, densely silvery pubescent, brown round insertions of legs. Abdomen brownish black with anterior margin of second segment brown and a brown transverse dorsal marking on third segment, posterior margins of remaining segments lined brown, widely so on seven and eight, segments silvery pubescent laterally. Opercula yellowish green, left (seen from ventral) slightly overlapping right, finely silvery pubescent, external angles almost at 90 degrees, internal evenly rounded, margins recurved. Underside of abdomen yellowish green or yellowish, finely silvery pubescent along anterior segmental margin, densely so at junctions of tergites and sternites.

Type: British Museum.

Macrotristria nigrosignata Distant.

Macrotristria nigrosignata Distant, 1904, Trans. ent. Soc. Lond.: 673, pl. 29, figs. 7a, b.
Macrotristria nigrosignata Distant, 1906, "Syn. Cat. Hom." 1: 32.
Macrotristria nigrosignata Ashton, 1914, Trans. roy. Soc. S.Aust. 38: 348.
Macrotristria nigrosignata Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 101.

Two specimens, fortunately a pair, in the collection of the Western Australian Museum were included amongst a lot of material kindly loaned to me for study from that institution. In size, colouration, general pattern and appearance, this interesting species very closely resembles *M. frenchi* Ashton, but may at once be distinguished by its reddish brown colour, in the male by the rather small pale yellowish fawn opercula, and in both sexes by the absence of black fascia bordering the ocelli and the presence of a yellow frontal band on the head between the eyes and frons. The female specimen unfortunately does not bear a date on the label, but the male was taken in January, 1957, so it is a summer species.

Body length, male, 34·0 mm., female, 36·0 mm. Head, wider than pronotum, including frons, reddish brown, openly and slightly ridged longitudinally, a narrow yellow frontal band from eyes to frons where it curves back as a fine line on either side to its margin; a faint yellowish patch adjoining each eye and extending to beyond first sulcus of pronotum. An interrupted groove on each side of ocelli and a rather deep median groove from anterior ocellus to posterior margin. Ocelli reddish brown vitreous, not quite equidistant, fairly closely grouped, anterior in line with front margin of eyes. Frons prominent, rather acutely rounded, faintly grooved from vertical angle to clypeus, transverse ridges well defined, 12 in number, interstitial grooves silvery pubescent. Genae reddish brown, silvery pubescent, margins yellowish and strongly carinate. Antennae reddish brown. Clypeus reddish brown, keeled

medianally, sides sparsely silvery pubescent. Labrum slightly paler in colour, grooved medianally, sides very slightly convex. Labium pale reddish brown with dark brownish black tip, grooved as labrum, reaching almost to middle of posterior coxae.

Thorax, width, male, 14·0 mm.; female, 13·5 mm. reddish brown, concolorous with head. Pronotum with three well defined sulci either side of midline, very finely sculptured (almost punctate), anterior margin finely lined yellow, posterior marginal band very wide, posterior two-thirds yellowish, transversely striate. Lateral margin of pronotum yellowish, slightly and acutely lobed anteriorly. Mesonotum dark reddish brown with a faint, depressed, inwardly curving fine line on either side of mid-line from anterior margin to half-way; upper lateral margin silvery pubescent, cruciform elevation well developed, reddish brown, posterior arms slightly paler, depressions lightly silvery pubescent, two lateral ones transversely striate, lower posterior margin edged pinkish yellow, strongly carinate. Wings, anterior, length, male, 44·0 mm., width, 14·0 mm.; female, 42·0 mm., 14·5 mm., clear vitreous, all veins reddish brown excepting Sc, CU2 and 1A, which are yellowish brown, basal cell reddish brown.

Posterior, male, length 25·5 mm., width, 12·0 mm.; female, 26·0 mm., 12·5 mm. Clear vitreous, all veins reddish brown excepting CU1a, CU1b, CU2 and 2A which are yellowish brown; 3A widely margined translucent brown to half-way. Legs, reddish brown, posterior pair slightly paler, finely silvery pubescent; anterior femora with two large and one very small spines first just anterior to half-way, second at three-quarters, third and smallest at base of second. Posterior tibiae with five spines, two exteriorly, three interiorly, first exterior at half-way, second slightly more than three-quarters; first interior a little anterior to first exterior, second at two-thirds, third midway between second exterior and distal. Underside of thorax light reddish brown suffused yellowish and silvery pubescent. Abdomen reddish brown, silvery pubescent, especially dorso-laterally and laterally. Opercula small, concolorous with underside of thorax, which is pale reddish brown and silvery pubescent, external angles obtusely open, internal very acute, internal margins fairly widely separated. Underside of abdomen pale reddish brown and almost uniformly silvery pubescent, median portions of first three segments widely suffused yellowish, others less so excepting penultimate segment which is almost completely pale yellowish brown.

Type: Brit. Mus. (♂)

Macrotristria frenchi Ashton.

Macrotristria frenchi Ashton, 1914, Proc. roy. Soc. Vict. (N.S.) 27: 12, pl. 2, fig. 2.

Macrotristria frenchi Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 102.

An apparently rather rare species found only in the north of the Northern Territory and Western Australia; it is similar in shape to *M. sylvara* (Distant) a common North Queensland species. It is one of the dullest coloured species of the genus and in general appearance and size comes very close to *M. nigrosignata* Dist. from North Western Australia. I have been able to examine nine specimens only, three males and six females (one being the type), one pair from the type locality (Catherine River, N.T.), one female from Derby,

North Western Australia, and two males and three females from Tennants Creek, N.T. Unfortunately no information is available regarding its habits, it is a summer species occuring from December to February. Body length, male, average (3), 32·2 mm., + ·2 — ·2 mm.; female, average (6), 30·6 mm., + ·4 — 1·1 mm. Head considerably wider than pronotum, smooth, yellowish brown (including frons) a slight depression on either side anterior to ocelli, and a short open median groove from anterior ocellus to posterior margin. Ocelli garnet vitreous, not quite equidistant, closely grouped, surrounded by a narrow dull black fascia. Anterior ocellus slightly in front of line of eyes. Frons, rounded and prominent, openly grooved from vertical angle to clypeus, transverse ridges 9–10 in number, slightly darker in colour, interstitial grooves very finely and sparsely silvery pubescent. Genae dull black, silvery pubescent, margins sharply carinate, yellowish. Antenna with first basal joint brownish, second brownish with apical portion black, remainder dark brownish black. Clypeus pale greenish brown, widely keeled, dark shining brown, silvery pubescent; labrum shining chestnut brown, grooved medianally, sides slightly convex; labium shining chestnut brown, tip blackish brown, grooved as labrum; reaching anterior margin of posterior coxae. Eyes opalescent brownish yellow. Thorax, width, male 32·0 mm., female, average (3), 31·4 mm., dark brown, almost devoid of markings. Pronotum dark chestnut brown, almost smooth, three well defined sulci on either side of midline, a small central oval shaped black marking on anterior margin of posterior marginal band which is yellowish, wide, and transversely striate. Lateral margin of pronotum yellowish, openly lobed anteriorly. Mesonotum very dark chestnut brown, smooth, sometimes its anterior margins bordered black, on either side of median from anterior margin to half-way a fine inwardly curved darker line faintly lined yellowish along anterior margin. Upper lateral margin yellowish, silvery pubescent. Cruciform elevation well developed, pale yellowish brown with a faint pinkish suffusion, posterior arms slightly longer than anterior, depressions silvery pubescent, lower lateral margin carinate and concolorous with cruciform elevation. Metanotum brownish. Wings, anterior male, length, average 42·0 mm., width, 13·5 mm., female, average (6) 41·4 mm., 13·4 mm., clear vitreous with all veins beyond first branch dark brown; Costal, Sc. R. and others pale yellowish brown to first branch. Posterior, length, male, 22·5 mm., width, 10·25 mm., female, average, 22·6 mm., 11·0 mm., clear vitreous with veins dark brown excepting RS, M, and CU1a which are yellowish to a little beyond first branches; 2A and 3A bordered translucent pale brown, 3A very widely towards base. Legs chestnut brown, coxae and junctions of femora and tibiae marked yellowish. Anterior femora with two large and one very small spines, anterior at less than half-way, second (largest) at three-quarters, third and smallest near base of second. Posterior tibiae with five spines, two exteriorly, three interiorly; first exterior at half-way, second close to distal; first interior directly opposite first exterior; second at three-quarters, third closer to distal than second exterior. Underside of thorax dark brownish black, silvery pubescent especially along junctions of sclerites. Abdomen dark brownish black, paler dorsally on segments 1–4, short silvery pubescence along intersegmental margins, penultimate segment with its posterior margin widely yellow. Opercula large, dark brownish black with lighter area towards external margins, finely silvery pubescent; external angles obtuse and open, internal rounded at almost 90 degrees; interior margins not widely separated. Underside of abdomen black, shining mid ventrally, penultimate segment yellowish-brown black; anterior margins silvery pubescent along intersegmental margins, densely so at junctions of tergites and sternites.

Type—(female) Aust. Mus.

Macrotristria extrema (Distant).

Cicada extrema Distant, 1892, Ann. Mag. nat. Hist. (6) 10: 56.

Cicada extrema Goding and Froggatt, 1904, Proc. Linn. Soc. N.S.W., 29:: 583.

Macrotristria extrema Distant, 1906, "Syn. Cat. Hom." 1: 32.

Macrotristria extrema Ashton, 1914, Trans. roy. Soc. S.Aust., 38: 347.

Macrotristria extrema Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 101.

This species bears a superficial resemblance to *M. dorsalis* Ashton but is larger; in his note following the original description Distant states, "This somewhat large species of cicada is allied to *C.* (Macrotristria) *intersecta* Walker, and like that species has the pale apex to the abdomen; but *C. extrema* may be at once recognized by the more robust and less symmetrical body, the head and thorax being relatively wider, the unspotted head and thorax, the longer second apical area to the tegmina, &c." The habitat given is Australia, Swan River. All the specimens I have before me (4 ♂♂ 4 ♀♀) are from Fortescue River, Hammersly Road, Western Australia. No dates are given; also 1♂ from Nullagine, W.A., January, 1957, A. Douglas, and 1♀ from Derby, W.A., October, 1955, A. Douglas, and Canarvon, W.A., 1♂. Body length, male, average (4), 31·8 mm., + 0·7 mm., — 0·8 mm.; female, average (4), 30·2 mm., + 1·3 mm. — 2·7 mm. Head equal in width to pronotum, smooth, yellowish brown (including frons) without markings excepting for a fine black line surrounding each ocellus. A weak sulcus exterior to ocelli on each side and a median shallow groove from anterior ocellus to posterior margin. Ocelli pinkish yellow vitreous, closely grouped, distance between two posterior almost twice that between anterior and each posterior. Frons concolorous with head, prominently rounded, transverse ridges, 8 in number, fairly well defined, interstitial grooves silvery pubescent only near junction of frons and genae; front of frons not actually grooved but weakly lined darker from vertical angle to clypeus. Genae slightly darker yellowish brown, silvery pubescent, external margins carinate. Clypeus concolorous with frons, keeled medianally, sides planate, silvery pubescent; labrum yellow, grooved medianally, sides planate; labium yellowish, base gradually becoming dark brown at tip, grooved as labium, almost reaching anterior margins of posterior coxae. Eyes opalescent yellowish brown.

Thorax, width, male, average (4), 13·1 mm., female 13·1 mm. Concolorous with head, three well defined sulci on either side of midline, posterior marginal band wide, finely striate transversely, lateral margins of pronotum carinate, lobed anteriorly. Mesonotum yellowish brown very faintly and obscurely marked dark brown, on either side of midline from anterior margin almost to half-way an inwardly curving linear groove; upper and lower margins carinate, finely silvery pubescent. Cruciform elevation well developed, yellowish brown, apex broad, anterior arms slightly longer than posterior, depressions silvery pubescent. Metanotum yellowish brown. Wings, anterior, male, average length (4), 41·1 mm., width 13·7 mm.; female, average (4), 40·2 mm., 13·8 mm. Clear vitreous, veins yellowish (may be green in life) becoming yellowish brown towards first cross veins, beyond these to, and including ambient vein, brown; 1A also brown; basal cell almost all clear vitreous. Posterior, average length, male, 23·8 mm., width, 11·5 mm.; female, 22·8 mm., 11·6 mm. Clear vitreous with veins yellowish becoming yellowish brown towards first cross veins, beyond these brown; ambient vein also brown; CU2, 2A and 3A margined opalescent whitish. Legs pale yellowish or yellowish brown with darker markings mainly on middle and posterior femora and tibiae. Anterior femora with two large and one small spines, first half-way, second just beyond three-quarters, third

dorso lateral areas paler chocolate brown. Lateral margin becoming yellow anteriorly and forming a very slight lobe. Posterior marginal band wide, dark chocolate brown, finely striate transversely, posterior margin lined yellow. *Mesonotum* dark chocolate brown, on either side of midline a fine inwardly curving yellow line to half-way, a little exterior to termination of this line a small obscure yellow spot. Upper lateral margin yellowish, finely silvery pubescent. Cruciform elevation well developed, acutely convex at apex, dark chocolate brown with arms yellowish brown, depressed areas densely silvery pubescent, anterior arms longer than posterior. Lateral margin yellowish, also silvery pubescent. Metanotum dark chocolate brown. Wings, length, anterior, male, 31·0 mm., width 10·5 mm.; female, average (4) 32·7 mm., 10·1 mm. Clear hyaline with veins dark chocolate brown excepting R, M from junction with M1, and terminal portions of R4 + 5, M1, M2, M3 and M4 from discal cross veins to near ambient vein where they become chocolate brown; basal cell translucent brown. Posterior, male, length, 18·5 mm., width 8·5 mm.; female, average (4) 18·6 mm., 8·8 mm. Clear vitreous with most of veins yellow, others including ambient, RS, M, to ends of cells enclosed by them, and basal half of CU2, chocolate brown; 3A widely margined translucent brown. Legs pale chocolate brown, tibiae and tarsi slightly darker, very finely and sparsely silvery pubescent, anterior femora with two large spines and a small tuberculate spine, anterior half-way, second three-quarters, third (tuberculate) almost at base of second. Posterior tibiae with five spines, two externally, three internally; first exterior less than half-way, second just beyond three-quarters; first interior opposite first exterior, second at two-thirds, third midway between second exterior and distal. Underside of thorax centrally chocolate brown shading to yellowish brown towards lateral margins, finely though densely silvery pubescent. Opercula fairly large, chocolate around basal spine, otherwise yellowish; external angles almost 90 degrees, internal semicircular, interior margins close together but separated. Underside of abdomen dull chocolate brown, minutely silvery pubescent, posterior margin of segments yellowish, penultimate segment widely so.

Type, female, S.A. Museum, Cotypes, Aust. Mus.

Macrotristria dorsalis Ashton.

Macrotristria dorsalis Ashton, 1912, Mem. nat. Mus. Vict. 4: 30, pl. 4, figs. 1, 2.

Macrotristria dorsalis Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 101.

This cicada is an inhabitant of Northern Queensland and appears to be found mainly in the Cairns and Atherton Tableland district. Specimens examined have come from Cairns, Mareeba, Herberton, Mt. Molloy, &c. It is not uncommon. I have little data regarding its habits, it seems to be mainly found in places where there is an intermingling of savannah and rain forest. It is quite a pretty species easily recognizable by the triangular shaped black marking on the abdomen dorsally. Ashton (Mem. Nat. Mus. Vict. 1912, No. 4: 30) states that it is allied to *M. intersecta* Walk. and *M. sylvanella* G. & F. by its shorter abdomen and overlapping opercula. The latter is not always the case because about 40 per cent. of the specimens examined have the internal margins of the opercula close together but not overlapping. "Differing from *extrema* Dist. by the narrower head and thorax; the dark fascia on the dorsum renders it easily recognizable". The sexes are very similar in size and appearance. Body length, male, average (10) 24·6 mm. + 2·4 mm. —1·6 mm.; female, average (10),

and smallest approximately half-way from second to distal. Posterior tibiae with fine spines, two exterior, three interior; first exterior just beyond half-way, second just beyond three-quarters; first interior half-way, second three-quarters, third midway between second exterior and distal. Underside of thorax pale yellowish brown, very finely silvery pubescent. Abdomen reddish brown, silvery pubescent, posterior margin of seventh segment and almost all of eighth yellowish. Opercula pale yellowish, minutely pustulate, external angles almost 90 degrees—internal fairly evenly rounded, right (seen from ventral) slightly overlapping left, basal spine long, situated almost at centre of basal margin. Underside of abdomen yellowish brown excepting segments eight and nine, finely silvery pubescent.

Type: British Museum.

It is rather doubtful if the type locality given by Distant (Ann. Mag. nat. Hist., 1892 (6) 10: 56) "Australia, Swan River" is correct. In recent years a good deal of systematic collecting has been done near Perth and I have been privileged to examine most of the Cicada material from S.W. Australia, but no specimen of this species has been noted from that area. All the above mentioned localities are remote from Swan River districts.

Macrotristria vulpina Ashton.

Macrotristria vulpina Ashton, 1914, Trans. roy. S.Aust. 33: 348, pl. 12, fig. 2.

Macrotristria vulpina Ashton, 1921, Proc. roy. Soc. Vict. (N.S.) 33: 102.

This is the smallest species in the genus and in general appearance resembles *M. occidentalis* Distant excepting that there is no infuscation bordering the cross veins or terminals of main veins in the anterior wings. I have been able to examine in all only five specimens; one male and one female from the collection of the late F. E. Wilson, and three females (including Type female) from the S.A. Museum collection. This is essentially a Western Australian species ranging as far as is at present known, from Carnarvon across to Cue and to the coast at Roeburne. None of the specimens bears a date on the labels, so its actual time of appearance is uncertain. I would expect it to be late spring or early summer. All the specimens examined have been collected by the late H. W. Brown. Body length, male, 22·0 mm., female, average (4), 23·6 mm., + 1·4 mm., —1·1 mm. Head, equal in width to pronotum; including frons, dark chocolate brown, coarsely sculptured, pale golden pubescent in depressions, a frontal yellow band from margin of frons almost to eyes, another yellow spot on vertical angle of frons, a median groove from anterior ocellus to posterior margin. Ocelli bright red vitreous, closely grouped, not quite equidistant, anterior ocellus a little in front of line of eyes. Frons prominent, rather acutely rounded, front from vertical angle to clypeus planate, transverse ridges 9–10 in number, fairly well defined, interstitial grooves silvery pubescent. Genae chocolate brown and densely silvery pubescent, lateral margins finely carinate. Antennae chocolate brown. Clypeus chocolate brown, silvery pubescent, finely keeled, a small pale spot in centre of front; labrum yellow, grooved medianally, sides slightly convex; labium dark chocolate brown shading almost to black at tip, grooved as labrum, reaching middle of posterior coxae. Eyes opalescent dark brown. Thorax, width, male, 10·0 mm., female, average (4), 10·1 mm., dark chocolate brown almost without markings. Pronotum with three sulci on either side of midline, the one nearest it being the deepest; anterior margin dark chocolate brown which extends as a wide mid dorsal longitudinal band to posterior margin,

25·9 mm. + 1·1 mm. — 4·9 mm. Head slightly wider than pronotum, smooth, yellowish green and brown (including frons), devoid of pubescence, a weak open sulcus exterior to ocelli on either side and a median fairly open groove from anterior ocellus to posterior margin. Insertion of frons dorsally finely lined black, ocelli each narrowly encircled black, usually just exterior to each lateral ocellus a small black irregular marking which occasionally tends to coalesce with the black surrounding these ocelli; the latter closely grouped and nearly equidistant, anterior ocellus in line with front margin of eyes. Frons concolorous with head, prominent and openly rounded, transverse ridges clearly defined, 9 10 in number, interstitial grooves without pubescence; front smooth with a faint median darker line from just below vertical angle to clypeus. Genae black, silvery pubescent, external margins finely yellowish, carinate. Antennae black. Clypeus yellowish with a black marking on either side, usually in upper part, front acutely rounded, sides silvery pubescent. Labrum pale brown, grooved medianally, sides planate; labium pale brown with tip blackish, grooved as labrum, reaching anterior margin of posterior coxae. Eyes opalescent brownish. Thorax, width, male, 10·1 mm., female, 10·1 mm., smooth, concolorous with head; three rather deep well defined sulci on either side of midline, a faint darker median longitudinal marking from anterior margin to posterior marginal band, the latter fairly wide, transversely striate, lateral margin slightly lobed anteriorly. Mesonotum with a triangular black marking (variable in size in different specimens) from anterior margin almost to half-way on either side of midline, the former finely lined black; just in front of each anterior arm of cruciform elevation a small blackish spot. Cruciform elevation well developed, unicolorous with mesonotum, arms short and of equal length; depressions finely silvery pubescent; upper lateral margin finely brown, silvery pubescent, lower as upper, carinate. Metanotum dark brown. Wings, anterior, male, average length, (10), 34·3 mm., width, 11·3 mm.; female, (10), 33·8 mm., 11·3 mm. Clear vitreous, costal, subcostal and radial veins yellow (probably green in life) to junction with R2 from which they are black, 1A black, others yellowish brown, basal cell infuscated transluscent yellow. Posterior, male, average length, (10), 18·5 mm., width, 9·6 mm.; female, 18·4 mm., 9·3 mm.; clear vitreous, veins yellowish (probably green in life) excepting ambient which is yellowish brown or brown, 2A and 3A margined translucent brown. Legs, coxae and femora yellowish, anterior and middle tibiae and tarsi brown, posterior yellowish. Anterior femora with two large and a minute spine, anterior about half-way, second three-quarters, third and smallest near base of second towards distal. Posterior tibiae with five spines, two externally, three internally; first exterior half-way, second, three-quarters; first interior slightly in front of first exterior, second posterior to second exterior, third almost at distal. Underside of thorax and opercula yellowish or pale yellowish brown. Abdomen yellowish brown, each segment to penultimate with a black dorsal band transversely widest on first and gradually decreasing in width in each segment towards apex thus forming a triangular black dorsal patch, and a row of small black spots on 4–7 inclusive (normally) just above this lateral margin. Opercula with the external angles very openly obtuse, internal angles acutely rounded, margins carinate, basal spines fairly long and, near middle of base of opercula. Underside of abdomen yellowish brown, posterior margin of segments 2–6 inclusive very narrowly lined darker brown; sparsely and finely silvery pubescent at junction of tergites and sternites. This species bears a very close resemblance to *M. extrema* Ashton, but is smaller, the head less prominently rounded, and opercula with the exterior angles much more obtusely rounded.

Type: Nat. Mus.

Macrotristria kalungura sp. nov.

Amongst the material before me are 3 ♂♂ and 7 ♀♀ of this interesting new species which bears a general appearance to *M. dorsalis* Ashton, but is larger and in shape resembles *M. extrema* (Distant). It is a coastal species, and the specimens examined are from Port Denison (Bowen) 2 ♂♂, Barron R., January, 1 ♂, one female labelled N.S.W. 11'04, 2 ♀♀ Mackay, December; Green Island 2 ♀♀, December and January respectively; Brisbane 1 ♀, January; and 1 ♀, Dunk Island, January. There is some doubt as to the correctness of the two localities, Brisbane and New South Wales. The only information I have regarding its habits is that it is found in rain forest. Body length, male, average (3), 31·0 mm.; female, average, (7), 30·3 mm. Head considerably wider than pronotum, smooth, yellow (may be greenish in life), almost entirely without markings. The ocelli are very narrowly margined black, and exterior to each lateral ocellus another very small black spot, posterior margin thinly lined black. A median groove from anterior ocellus to posterior margin. Ocelli fairly closely grouped, pale reddish vitreous, distance between two lateral twice that between anterior and each lateral. Frons concolorous with head, prominently rounded, transverse ridges 10–12 in number, slightly darker in colour, a longitudinal open groove from vertical angle to near clypeus. Genae yellow with inner half-black, silvery pubescent, external margins carinate, clypeus yellow, silvery pubescent excepting on keel, a black triangular shaped marking on either side of keel adjoining frons and extending downwards to about one-third; labrum yellow, grooved medianally, sides planate and shining; labium yellow with tip dark brownish black, grooved as labrum, reaching anterior margin of posterior coxae. Antennae black, eyes opalescent yellowish green.

Thorax, width, male, average (3), 12·1 mm., female, average (7), 12·7 mm. Pronotum very minutely sculptured, concolorous with head, and without any markings, three deep sulci on either side of midline, posterior marginal band wide, transversely and evenly striate, lateral margins of pronotum carinate, lobed anteriorly. Mesonotum almost concolorous with pronotum but a little darker, smooth but faintly and obscurely marked, on either side of midline a slightly inwardly curving fine groove from anterior margin to about one-third, cruciform elevation concolorous with mesonotum, wide across apex, arms rather short, posterior slightly longer than anterior, lateral depressions silvery pubescent, upper lateral margin of pronotum sparsely silvery pubescent, lower carinate and slightly paler in colour. Metanotum yellow or yellowish green. Wings, anterior, male, average length (3), 39·8 mm., width 12·3 mm.; female, average (7), 41·3 mm., 13·6 mm. Clear vitreous, costal, subcostal and radial veins yellow (or green in life), R1, R2, dark brownish black, all others excepting 1A which is blackish, to ends of main cells, yellow (or green), beyond yellowish brown or pale brown. Basal cell with upper half translucent greenish. Posterior, male, average length (3), 21·1 mm., width, 11·0 mm.; female, average (7), 22·7 mm., 10·8 mm. Clear vitreous with all veins yellow (or green) excepting ambient, 2A and 3A, which are brownish; these two latter margined translucent white. Legs yellow or greenish yellow, middle tarsi and anterior tibiae and tarsi pale brown; anterior femora with two large and one small spines, the anterior spine rather slender and at half-way, second much shorter and fairly close to distal, third and smallest distally at base of second. Posterior tibiae with three spines, two exterior and three anterior, first exterior half-way, second fairly close to distal; first interior opposite first exterior, second at three-quarters, third midway between second and distal. Underside of thorax

pale yellowish brown with blackish margin surrounding coxal insertions, silvery pubescent laterally and in depressions surrounding joints. Abdomen dark yellowish brown, anterior margins of segments 2–7 transversely on dorsal black, and diminishing in width on each segment towards 7, posterior margin of 7 broadly yellow, and almost all black with faint brownish suffusion on posterior margin, segments 3 to 7 with a black marking on each side above lateral margin; smallest on 3 and 4, larger on the others. All segments sparsely silvery pubescent. Opercula yellow, left overlapping right, (seen from ventral), minutely punctate, silvery pubescent, basal spine yellow, black at base. External angles openly and gently rounded, internal acutely so. Underside of abdomen yellowish brown, silvery pubescent at junctions of tergites and sternites.

Holotype male, S.A. Museum. (Port Denison, another label reads N.W.A. Det. H. Ashton.)

Allotype female, (Green Island N.Q. 21.1.35, A.B.). Coll. A.N.B. to be deposited in National Museum of Victoria.

Macrotristria bindalia sp. nov.

This interesting species bears a superficial resemblance to *M. frenchi* Ashton, but is slightly smaller and the mesonotum is considerably darker in colour. The head and frons are narrower and the latter is more acutely prominent and in all the specimens (7 ♂♂ 2 ♀♀) examined, and marked with black. Apparently rather local but not uncommon where it occurs—of the specimens before me, 6 ♂♂ and 1 ♀ are from Ayr, North Queensland, December 1957, and 1 ♂ 1 ♀ from Haughton Valley, North Queensland, (in same geographical region as Ayr), 6th January, 1959. The sexes are very similar and all the specimens exhibit very little variation in size and colour. It has been named *bindalia* from the name Bindali, the aboriginal tribe which inhabited the Ayr and surrounding district. Body length, male, average 29·8 mm. + 0·7 mm. — 1·8 mm.; female, average (2), 29·25 mm. + 0·75 mm. — 0·75 mm. Head considerably wider than pronotum, smooth, yellowish or yellowish green, a black spot on inner margin of each eye, ocelli margined black, posterior margin lined black dorsally, dorsal margin and upper part of lateral margins of frons finely lined black. An open median groove from anterior ocellus to posterior margin. Ocelli fairly closely grouped, reddish orange vitreous, anterior in line with front margin of eyes, distance between two posterior almost twice that between anterior and each posterior. Frons slightly darker in colour, marked frontally on transverse ridges with black, ridges 8–9 in number, interstitial grooves only fairly clearly defined. Genae black, silvery pubescent, external margin carinate, yellowish. Clypeus yellowish brown on keel, sides blackish, silvery pubescent, about half length of frons; labrum brown, shining, grooved medianally, sides planate, labium dark brownish black, grooved as labrum, almost reaching anterior margin of posterior coxae. Eyes opalescent yellowish brown or green. Thorax, width, male, average, 11·9 mm., female, 12·5 mm. Pronotum concolorous with head, anterior margin lined black; three rather deep sulci on either side of midline, these finely lined black in depressions, a small blackish median spot adjoining posterior marginal band which is wide, finely transversely striate and minutely punctate. Lateral margin of pronotum finely carinate, prominently lobed anteriorly. Mesonotum smooth, dark brownish black with obscure lighter brown dorsal markings and on either side of midline a fine depressed inwardly curving line to almost half-way; upper lateral margin brown, sparsely silvery pubescent, cruciform elevation yellowish brown, not transversely wide at apex, posterior arms slightly longer than anterior, anterior and lateral depressions sparsely

silvery pubescent, lower lateral margin of pronotum yellowish brown, carinate, sparsely silvery pubescent. Metanotum brown. Wings, anterior, male, average length (7), 40·2 mm., width, 12·2 mm.; female, average (2), 41·75 mm., width, 13·25 mm. Clear vitreous with veins brown excepting costal, subcostal and radial which are yellowish or greenish and 1A which is blackish. Cross veins from R3, — R4 + 5, — M, very faintly bordered translucent brown, basal cell with upper third translucent yellow. Posterior, average length, male, 21·2 mm., width, 10·2 mm.; female, 22·0 mm., 11·25 mm. Clear vitreous with most veins brown, CU1a and CU1b yellowish, 2A and 3A margined opalescent white. Legs yellowish or yellowish green with distal half of middle tibiae and tarsi brown, and anterior tibiae and tarsi. Anterior femora with two long sharply pointed spines and one very minute one, anterior spine at almost half-way, second two-thirds, third and smallest distally at base of second. Posterior tibiae with five spines, two externally, three internally, first exterior at half-way, second four-fifths; first interior opposite first exterior, second at two-thirds, third almost at distal. Underside of thorax dark brown mid ventrally, yellowish laterally, finely silvery pubescent. Abdomen dark brownish black, posterior margins of segments 2–6 inclusive, brown, 1–2 widely so; seven widely yellowish. Opercula pale yellow, basally dark brownish black, left overlapping right, (seen from ventral) external angles at an angle of about 90 degrees, internal sharply rounded. Basal spine long, fairly sharply pointed, situated exteriorly to half-way. Underside of abdomen yellowish or yellowish green, segments 1–7 inclusive brownish black midventrally; silvery pubescent along junctions of tergites and sternites.

Types: Holotype ♂ (Haughton Valley, Q., 6.1.59, G.B.), and Allotype ♀ (Haughton Valley, Q., 6.1.59, G.B.). Coll. A. N. Burns; to be deposited in the National Museum of Victoria.

Macrotristria douglasi sp. nov.

An interesting and pretty species so far recorded from Wotjulum near Yampi, and Yampi in north-western Australia. Apparently local but not uncommon when it occurs. I have had numerous specimens of cicadas from Yampi but only one (female) specimen of this species has so far been included. All the specimens examined belong to the W.A. Museum, and were collected by Mr. A. Douglas. Body length, male, average (10), 25·8 mm. + 0·7 mm. — 1·8 mm.; female, average (5), 26·9 mm. + 1·6 mm. — 1·4 mm. Head considerably wider than pronotum, anterior margin adjoining frons silvery pubescent, smooth, dark reddish brown with a transverse yellowish band between the eyes near the posterior margin, posterior margin of frons also narrowly yellowish. A slight sulcus on either side external to each lateral ocellus, an open longitudinal median groove from anterior ocellus to posterior margin. Ocelli closely grouped, not quite equidistant, pale red vitreous, anterior slightly in front of anterior margin of eyes. Frons light reddish brown in front and sides, transverse ridges 12 13 in number, fairly clearly defined, interstitial grooves slightly silvery pubescent. Genae yellowish, silvery pubescent, exterior margins carinate. Clypeus concolorous with frons, half the length of the latter, slightly keeled, sides silvery pubescent; labrum yellowish brown, grooved medianally, sides planate and shining, labium dark brownish black, grooved as labrum, reaching middle of posterior coxae. Antennae dark reddish brown, eyes opalescent reddish brown, margin slightly silvery pubescent.

Thorax, width, male, average (10), 10·5 mm.; female, average (5), 10·8 mm. Pronotum yellowish with three sulci on either side of midline, anterior margin carinate, margin lined dark brownish black and which extends on either side

of midline into a triangular shaped marking, grooves of sulci silvery pubescent and marked brownish black, which extends irregularly on to the intervening raised areas. Posterior marginal band fairly wide, reddish brown lined yellow along posterior margin, and extending along lateral margin of pronotum, very finely striate transversely; lateral margin feebly lobed anteriorly. Mesonotum dark brownish black, smooth, a median shaped yellowish linear marking, on either side of midline, another triangular shaped yellow marking, and near anterior margin dorso-laterally another small yellowish quadrate spot; from anterior margin on each side a pale chocolate inwardly curving line extending as far as the base of each dorsal triangular spot. Cruciform elevation yellowish becoming reddish brown at extremities of arms, the anterior of which are slightly longer than the posterior, the two lateral depressions yellowish, silvery pubescent, anterior dark brownish black, also silvery pubescent. Upper lateral margin of prothorax lined yellow, carinate, silvery pubescent; lower also yellow slightly carinate, silvery pubescent. Metanotum yellowish brown. Wings, anterior, male, average length (19), 34·3 mm., width 11·2 mm.; female, average (5), 34·9 mm., 11·1 mm. Clear vitreous, costal vein yellowish, all others pale brown to ends of main cells then dark brown; basal cell with upper half palely translucent yellowish brown. Posterior length, male, average (10), 19·0 mm., width, 9·0 mm.; female, 19·7 mm., 9·8 mm. Clear vitreous with veins dark brown excepting CU1, CU1a, CU1b, CU2 and 1A which are yellowish, CU2, margined left side translucent pale greenish yellow, 2A and 3A broadly so on both sides. Legs with middle femora and tibiae dark brown, posterior femora dark brown, anterior with yellowish markings and two large and one small spines; the anterior half-way, second fairly close to distal, third and smallest at base of second and nearer it than distal. Posterior tibiae yellowish, two spines exteriorly, three interiorly; first exterior half-way, second beyond three-quarters; first interior before half-way, second midway between first and second exterior, third midway between second exterior and distal. Underside of thorax black midventrally, sides yellowish and silvery pubescent. Abdomen black, anterior marginal lobes of second segment lined yellow, posterior half of seventh segment yellow, each segment broadly pale golden pubescent across its anterior margin. Opercula with inner halves black, outer yellowish, faintly silvery pubescent, right slightly overlapping left (seen from ventral), external angles openly rounded about 90 degrees, internal, rather acutely and evenly rounded. Underside of abdomen shining black, silvery pubescent, thickly so at junction of tergites and sternites.

Types: ♂ Holotype (Wotjulum W.A. 12.X.55, A. Douglas), and ♀ Allotype (Wotjulum W.A., 12.X.55, A. Douglas)—Western Australian Museum.

Macrotristria wororra sp. nov.

This species very closely resembles *M. douglasi* sp. nov. especially the pattern of markings, and also inhabits the same area. The specimens I have before me are from Wotjulum, W.A., October, 1955 (2 ♂ ♂ 2 ♀ ♀), Yampi, W.A. November, 1959 (5 ♂ ♂ 3 ♀ ♀) and Forrest River Mission (near Wyndham, W.A.) one male, January, 1954. From this data it evidently has a long season, from October until January but times of emergence may largely be governed by the occurrence of the early summer rains. It can easily be distinguished from *M. douglasi* by its larger size, yellow markings on the mesonotum, brownish red pronotum and much larger opercula which are normally yellow, one male examined shows a large black area on the inner sides.

Body length, male, average, (8), 28·6 mm. + 1·4 mm. — 2·6 mm.; female average, (5), 27·3 mm. + 1·2 mm. — 0·8 mm. Head considerably wider than

pronotum, smooth, yellowish brown with a wide transverse brownish black band, which encloses the ocelli, across vertex between eyes, orbits of the latter lined black, a weak sulcus exterior to each lateral ocellus and a weak median longitudinal groove from anterior ocellus to posterior margin; anterior margin along vertex of frons finely silvery pubescent. Ocelli closely grouped, not quite equidistant, garnet red vitreous; anterior in line with front margin of eyes. Frons pale reddish brown, darker on vertex, front with a fine median groove from near vertical angle to clypeus. Transverse ridges clearly defined, 10–12 in number, interstitial grooves finely silvery pubescent. Genae pale yellowish, silvery pubescent interior margin blackish, exterior sharply carinate. Clypeus pale yellowish brown, silvery pubescent, openly keeled, a small brown marking on keel beyond half-way to labrum, the latter concolorous with clypeus, grooved medianally, sides planate and shining; labium pale yellow tipped blackish, grooved as labrum, reaching posterior margin of hind coxae. Antennae blackish excepting basal and sub-basal segments which are yellowish, the distal end of the latter blackish. Eyes opalescent yellowish brown.

Thorax, width, male, average (8), 12·1 mm.; female, average (5), 12·2 mm. Pronotum very finely sculptured, chocolate brown, three rather sharp sulci on either side of midline, anterior margin blackish, carinate, a median yellowish brown longitudinal marking from near anterior to near posterior margin. Posterior marginal band fairly wide, finely striate transversely, yellowish with anterior half-dark blackish brown. Lateral margin of pronotum edged dark brown, openly lobed anteriorly. Mesonotum blackish brown, smooth, a median shaped linear yellow marking, on either side of midline another yellow marking extending from anterior margin to base of anterior arms of cruciform elevation; exterior to these markings an irregular shaped small yellow spot near anterior margin. Cruciform elevation dark chocolate brown, anterior arms longer than posterior; depressions silvery pubescent. Upper lateral margin of prothorax broadly lined yellow, silvery pubescent; lower yellow, carinate, silvery pubescent. Metanotum brownish black lined yellow dorsally. Wings, anterior; male, average length, (8), 38·0 mm., width, 12·7 mm.; female, average (5), 38·4 mm., 12·5 mm. Clear vitreous; all veins brown excepting costal, yellow; basal cell with upper half translucent yellow. Posterior, length, male, average (10), 20·4 mm., width, 9·8 mm.; female, average (5), 20·4 mm., 10·2 mm. Clear vitreous with most of veins brown, R to end of first cell, M and CU1, yellowish brown; CU2 margined on left side to translucent whitish, R2 and R3 broadly so on both sides. Legs yellowish brown with pale brown markings, terminal joint of tarsi blackish; anterior femora with two large and one small spines, anterior almost half-way, second three-quarters, third and smallest distally at base of second. Posterior tibiae with five spines, two externally, three internally; first exterior just beyond one third, second just beyond three-quarters; first interior almost half-way, second two-thirds, third midway between second exterior and distal. Underside of thorax pale yellowish and silvery pubescent, blackish round insertions of coxae. Abdomen black, finely pale golden pubescent, anterior lobes of second segment widely margined yellow, posterior margin of segments 3–6 yellow, 7 widely so, 8 yellow with posterior margin black. Opercula pale yellow, minutely punctate, right overlapping left (seen from ventral), external angles almost 90 degrees, internal rounded. Underside of abdomen yellow, silvery pubescent, second, fifth and sixth segments marked black midventrally.

Types: ♂ Holotype (Yampi, W.A., Nov. 1959, B. Clarke). ♀ Allotype (Yampi, W.A., Nov., 1959, B. Clarke)—Coll. A. N. Burns—to be deposited in National Museum of Victoria.

Macrotristria intersecta (Walker).

Fidicina intersecta Walker, 1850, "List. Hom. Br. Mus.": 97.
Fidicina internata Walker, 1850, ibid.: 98.
Fidicina prasina Walker, 1850, ibid.: 100.
Fidicina prasina Stäl, 1862, "Ofv. Vet.-Ak. Forh.": 481.
Cicada sylvanella Goding and Froggatt, 1904, Proc. Linn. Soc. N.S.W. 29: 582.
Cicada intersecta Goding and Froggatt, 1904, ibid.: 584.
Macrotristria intersecta Distant, 1906, "Syn. Cat. Hom." 1: 32.
Macrotristria sylvanella Distant, 1906, ibid. 1: 32.
Macrotristria intersecta Distant, 1912, "Gen. Ins." 142: 26.
Macrotristria intersecta Ashton, 1914, Trans. roy. Soc. S.Aust. 38: 347.
Macrotristria intersecta Ashton, 1921, Proc. roy. Soc. Viet. (N.S.) 33: 101.

This is essentially a northern Australian species, the Type coming from Port Essington. I have been able to examine a very long series of specimens of this extremely variable cicada: which varies very much in size as well as colour. The description given is that of a typical medium coloured male. Apparently three well defined colour varieties are met with, the yellowish green without markings on the thorax, the ocelli with a narrow black fascia, the frons with brownish black marking on the front on either side of the midline, the opercula blackish brown basally and the abdomen dark brown along the anterior margin of each segment. Medium coloured specimens which have the colour of the head and pronotum yellowish green with the black ocellular fasciae wider, the frons more heavily marked, the opercula with more extensive brownish black basally, the thorax considerably darker, and the mesonotum brown with blackish markings. Very dark specimens which are less common have the head and pronotum yellowish or pale yellowish brown with blackish markings on frons, head and opercula, as in medium specimens, the abdomen is brownish with the anterior margin of the segments widely blackish, and the mesonotum brown with black markings. I have been privileged to examine Goding and Froggatt's type of *M. sylvanella* (Proc. Linn. Soc. N.S.W., 1904: 582–583) and agree with Ashton (Trans. roy. Soc. S.Aust. 1914: 347) where he states "After careful examination of the type specimen of Goding and Froggatt's *M. sylvanella* in the Macleay Museum, Sydney, I have no hesitation in declaring that this is merely a pale and narrow bodied variety of Walker's species". Amongst the many specimens of *M. intersecta* I have examined are over twenty which agree in colour with *sylvanella*. These vary much in size and careful examination (including genitalia) shows them all to agree with *intersecta*, the only differences being in size. Specimens examined have come from Yampi and near Wyndham, N.W.A., Darwin; Groote Eylandt; Coen; several localities on Cape York, Kuranda, Port Denison (Bowen), Mt. Isa., Katherine, Townsville and Magnetic Island. Measurements were made of 20 males and 20 females which included a graded range in sizes from the smallest to the largest specimens. Body length, male, average (20), 28·0 mm., + 2·5–3·0 mm.; female, average (2) 25·9 mm., + 2·1–4·9 mm. Head slightly wider than pronotum, smooth, yellowish green with black markings which vary in extent and tendency to coalesce in individuals. An angular median groove from anterior ocellus to posterior margin, exterior to ocelli on either side a weak sulcus from near anterior to posterior margin. Adjoining each eye a dorsal black marking, ocelli surrounded black which extends beyond each lateral ocellus and continues back to the posterior margin thus enclosing a yellowish green area behind the ocelli which are fairly closely grouped, not equidistant, pinkish yellow vitreous. Anterior ocellus in line with front margin of eyes. Frons more yellowish and slightly darker in colour than

head, a dorsal W shaped marking on vertex, transverse ridges 7–8 in number and marked black on either side in front forming an inverted U shaped marking, interstitial grooves not pubescent. Genae black, silvery pubescent, exterior margins lined yellow, carinate. Clypeus yellowish, not sharply keeled, sides black, silvery pubescent, an obscure very small divided brown marking on centre of the keel which is slightly more than half the length of the frons; labrum pale yellowish, grooved medianally, sides planate, shining; labium dark brownish black, grooved as labrum, reaching anterior margin of posterior coxae. Antennae dark brown, eyes opalescent yellowish or yellowish brown, margins silvery pubescent posteriorly.

Thorax: width, male, average (20), 11·0 mm., + 1·0–2·0 mm.; female, average (10), 11·4 mm., + 1·1–2·4 mm. Pronotum yellowish or yellowish green, anterior margin slightly carinate, three well defined rather deep sulci on either side of midline, these lined black along depressions, a small median black spot adjoining posterior marginal band; this fairly wide, slightly paler in colour, very finely striate transversely, lateral margin of pronotum with a distinct anterior lobe. Mesonotum reddish yellow or pale reddish brown, on either side of midline, a triangular shaped black marking from anterior margin to almost one-third; dorso-laterally another longer triangular black marking from anterior margin to ends of anterior arms of cruciform elevation yellowish or yellowish brown, its anterior depression black, posterior arms longer than anterior, apex fairly broad, depressions finely and sparsely silvery pubescent. Upper lateral margin of mesonotum finely carinate, silvery pubescent; lower pale yellowish, strongly carinate, silvery pubescent. Metanotum yellowish. Wings—anterior male, average length 33·8 mm., width, 11·2 mm.; female 36·2 mm., 11·5 mm. Clear vitreous, costal, subcostal, and radial veins yellowish green to junction with R2, other veins including ambient and excepting 1A which is blackish-brown. Basal cell faintly translucent yellowish. Posterior, male, average length, 18·0 mm., width, 10·1 mm.; female, 18·8 mm., 9·4 mm. Clear vitreous with veins brown, CU1 yellowish to junction with CU1a and CU1b; 2A and 3A bordered translucent greyish white. Legs pale yellowish, anterior and middle tibiae and tarsi brown, middle and posterior femora marked with brown. Anterior femora with two large and one small spines, anterior at half-way, second three-quarters, third and smallest near base of second. Posterior tibiae with five spines, two exteriorly, three interiorly; first exterior half-way, second beyond three-quarters; first interior opposite first exterior, second midway between two exteriors, third not quite half-way between second exterior and distal. Underside of thorax brownish black, yellowish or pale yellowish brown laterally, silvery pubescent.

Abdomen reddish yellow or pale reddish brown with anterior margins of segments two (sometimes one) to seven broadly blackish; posterior margins of these segments (excepting seven) narrowly lined yellowish, seven widely so. Opercula pale yellowish, dark brownish black basaly, very finely punctate, margins recurved; right (seen from ventral) slightly overlapping left, external angles openly and gradually rounded, internal acutely so. Underside of abdomen medianally blackish, lighter laterally, last two segments yellowish, shortly silvery pubescent at junctions of tergites and sternites.

Type: Brit. Mus.

Acknowledgments.

The writer wishes to thank the following:—

Mr. R. J. Izzard of the British Museum (Natural History) for valuable assistance in the loan of specimens, photographs and descriptions; Dr. J. Evans, Director of the Australian Museum, Sydney, for the loan of Types and specimens; Dr. W. D. L. Ride, Director of the Western Australian Museum, for the loan of specimens; Mr. H. M. Hale, Director, and Mr. G. Gross, Curator of Insects, South Australian Museum, for loan of specimens; Dr. A. R. Woodhill, Macleay Museum, Sydney, for loan of Types; Dr. T. E. Woodward, Department of Entomology, University of Queensland, for loan of specimens; the late Mr. F. E. Wilson, Hon. worker in Entomology, National Museum of Victoria, for loan of specimens; Mr. G. Brooks, Cairns, North Queensland, for sending specimens; Dr. J. Kerr of Brisbane, Queensland, for sending specimens; Mr. J. Macqueen of Mount Emlyn, Queensland, for sending specimens; Mr. B. Clarke, Head Teacher of the Government School, Yampi, Western Australia, for sending specimens; Mr. L. Wassell of Coen. North Queensland for sending specimens; Mr. C. King of Brisbane, Queensland, for sending specimens; and Mr. H. Thomas of Irymple, also for sending specimens.

The kind assistance rendered by the above is greatly appreciated.

References.

Ashton, J. H., 1912A.—Mem. nat. Mus. Vict. 4: 30, Pl.

Ashton, J. H., 1912B.—Proc. roy. Soc. Vict. 24: 223, Pl.

Ashton, J. H., 1914A.—Trans. roy. Soc. S.Aust. 38: 347, 348.

Ashton, J. H., 1914B.—Proc. roy. Soc. Vict. (N.S.), 27: 12, Pl.

Ashton, J. H., 1921.—Proc. roy. Soc. Vict. (N.S.) 33: 99–102.

Distant, W. L., 1901.—Trans. ent. Soc. Lond.: 591, Pl.

Distant, W. L., 1904.—Ann. Mag. nat. Hist. (7) 14: 329.

Distant, W. L., 1892.—Ann. Mag. nat. Hist. (6) 10: 56.

Distant, W. L. 1906.—" Syn. Cat. Hom." 1: 31, 32, 38.

Distant, W. L. 1907.—Ann. Mag. nat. Hist. (7) 20: 412, 413.

Distant, W. L., 1912A.—" Gen. Ins." 142: 26.

Distant, W. L., 1912B.—Ann. Mag. nat. Hist. (8) 10: 438.

Goding and Froggatt, 1904.—Proc. Linn. Soc. N.S.W. 29: 580–583.

Froggatt, W. W., 1895.—Proc. Linn. Soc., N.S.W.: 529.

Froggatt, W. W., 1903A.—Agric. Gaz., N.S.W., 14: 418, Fig.

Froggatt, W. W., 1903B.—" Misc. Publ., No. 643 ": 8, Pl.

Froggatt, W. W., 1907.—" Australian Insects ": 350, Fig.

Kirkaldy, G. W., 1910.—Canad. Ent 41: 391

McKeown K. W., 1942.—" Australian Insects ": 98.

Tillyard, R. J.—" Insects of Australia and New Zealand ": 162.

Walker, F., 1850.—" List. Hom. Br. Mus.": 97, 98, 100.

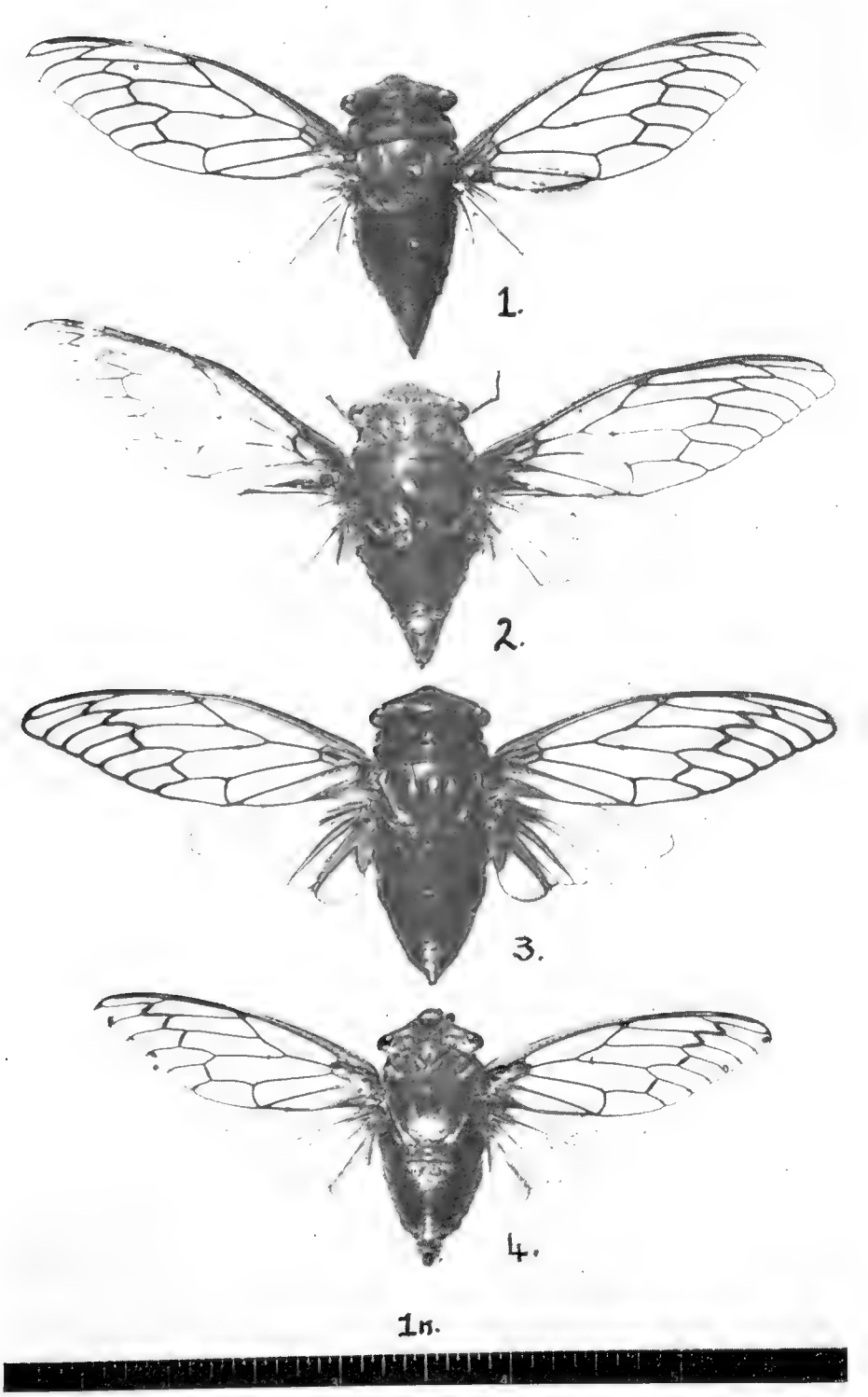


PLATE 1.

1. *Macrotristria maculicollis* Ashton, Type. (S.A. Museum.) 2. *Macrotristria nanda* sp. nov. Type female. (S.A. Museum.) 3. *Macrotristria angularis* (Germar), male. 4. *Macrotristria thophoides* Ashton, male.

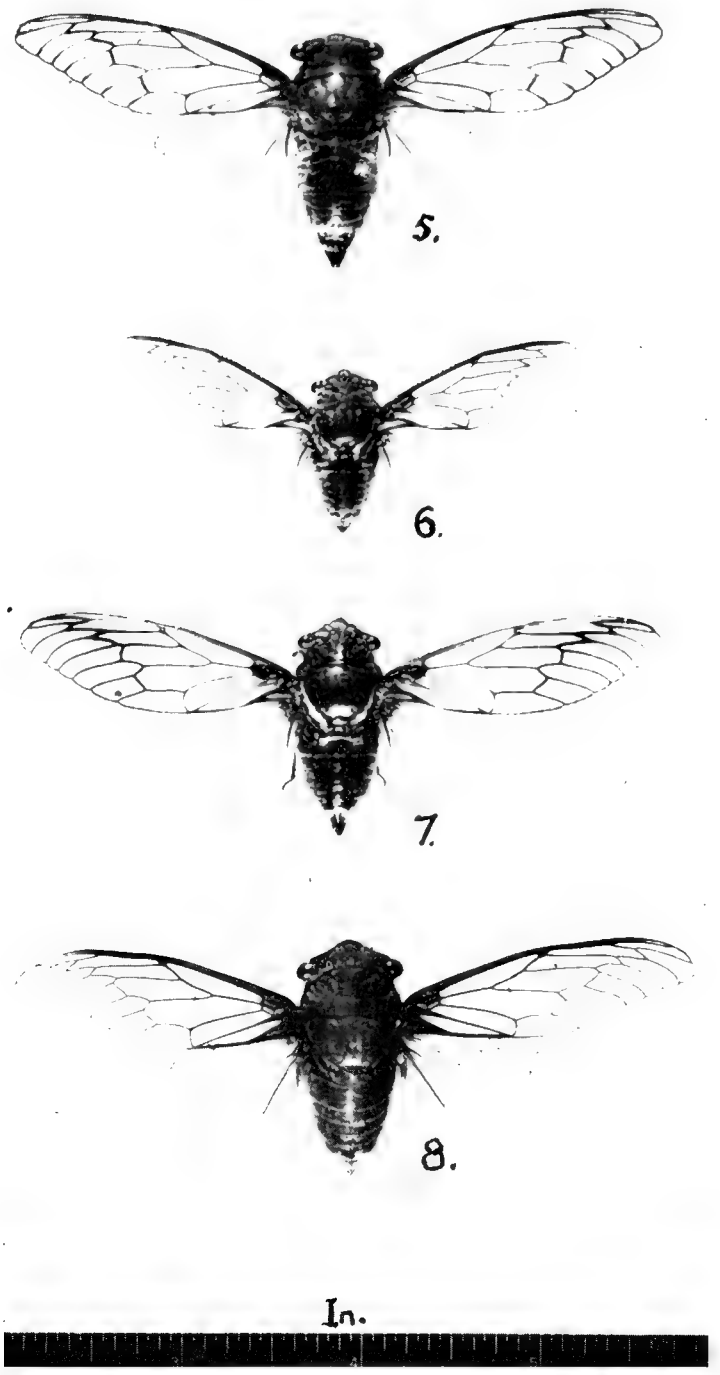


PLATE 2.

5. *Macrotristria doddi* Ashton, male. 6. *Macrotristria vulpina* Ashton, male. 7. *Macrotristria occidentalis* Distant, male. 8. *Macrotristria frenchi* Ashton, Type female. (Aust. Mus.)

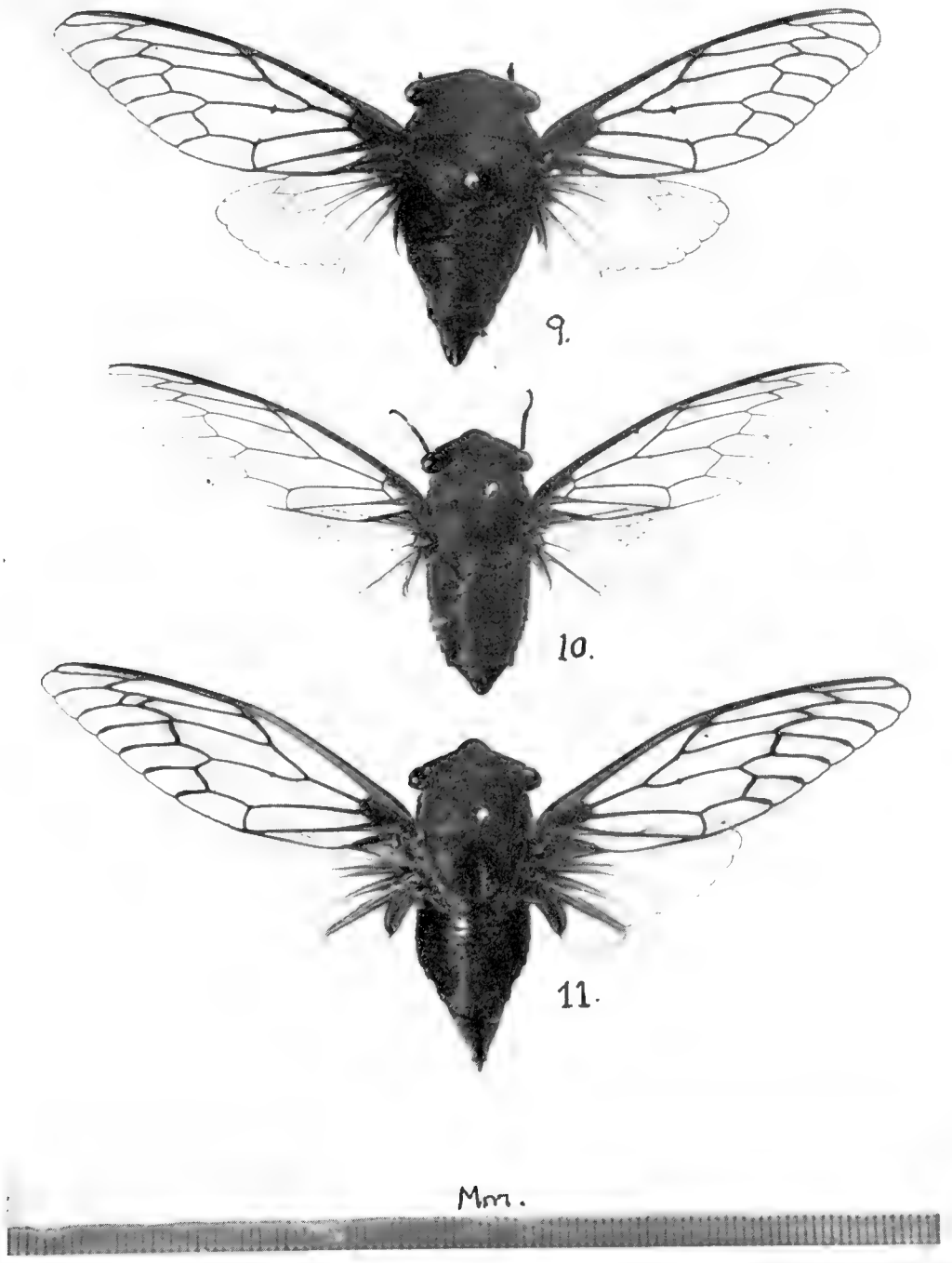


PLATE 3.

9. *Macrotristria hieroglyphica* (Goding and Froggatt), male. 10. *Macrotristria bindalia* sp. nov., male. 11. *Macrotristria kabikabia* sp. nov., female.

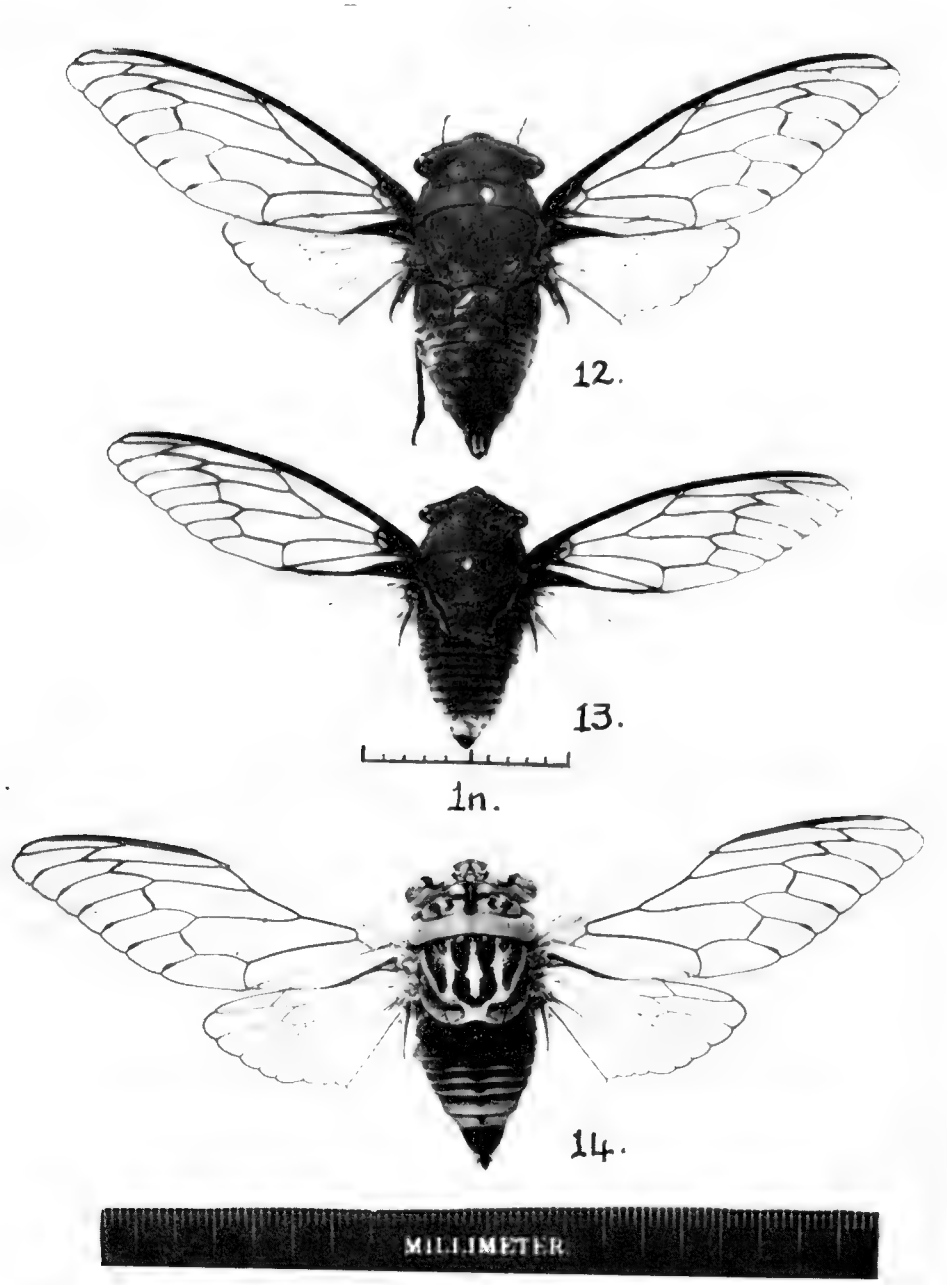


PLATE 4.

12. *Macrotristria sylvara* Distant, male. 13. *Macrotristria hillieri* Distant, male. 14. *Macrotristria godingi* Distant, female.

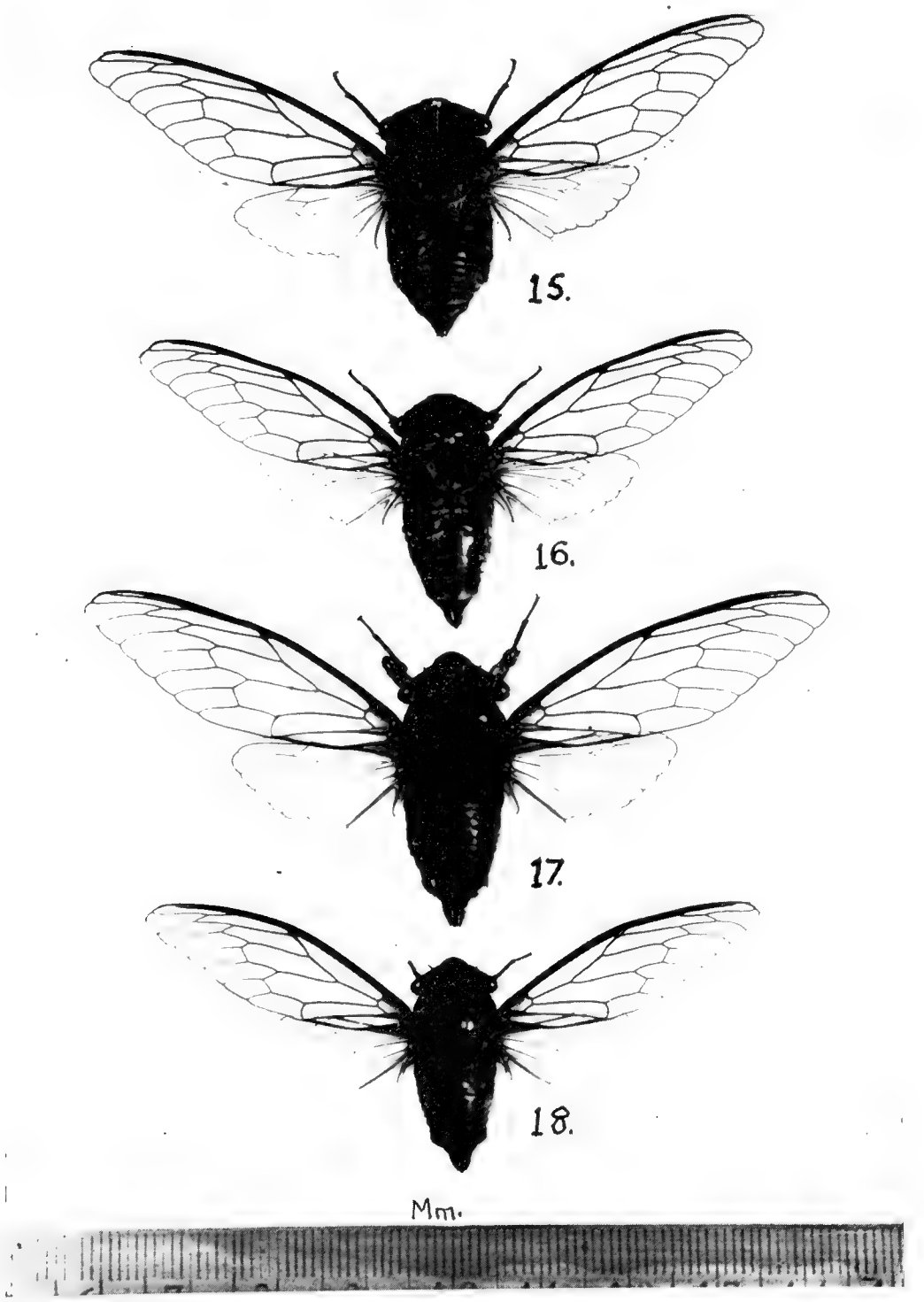


PLATE 5.

15. *Macrotristria worora* sp. nov., male. 16. *Macrotristria douglasi* sp. nov., male.
17. *Macrotristria kulungura* sp. nov., male. 18. *Macrotristria dorsalis* Ashton, male.

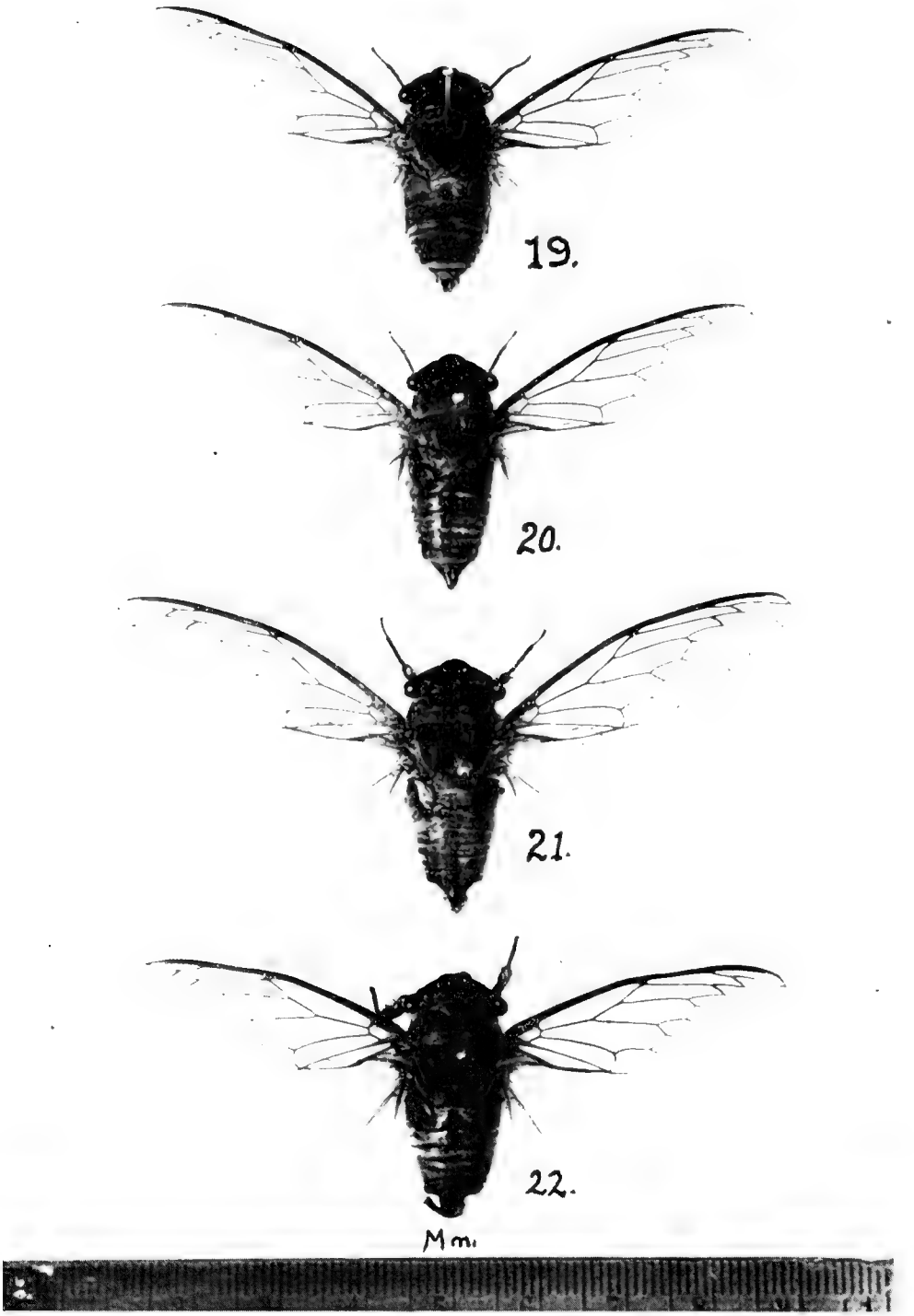
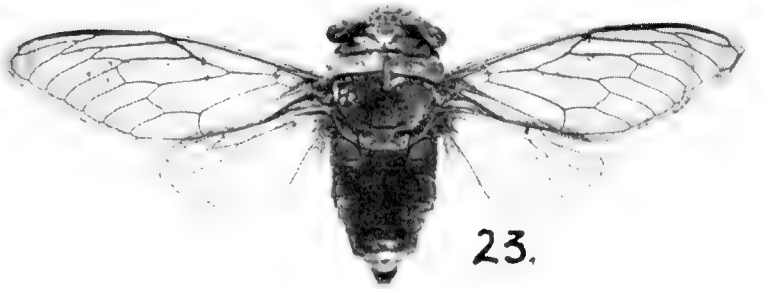


PLATE 6.

19. *Macrotristria intersecta* (Walker) normal male. 20. *Macrotristria intersecta* (Walker) pale coloured male. 21. *Macrotristria intersecta* (Walker) large normal male. 22. *Macrotristria intersecta* (Walker) large dark coloured male.



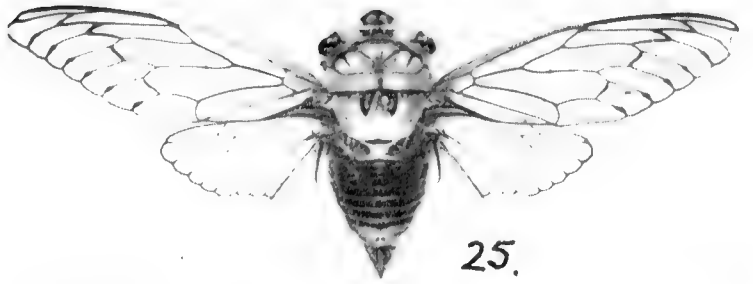


PLATE 7.

23. *Macrotristria extrema* (Distant) male, Type, Brit. Museum.
24. *Macrotristria nigrosignata* Distant, male, Type, Brit. Museum.
25. *Macrotristria nigronervosa* Distant, female, Type, Brit. Mus.

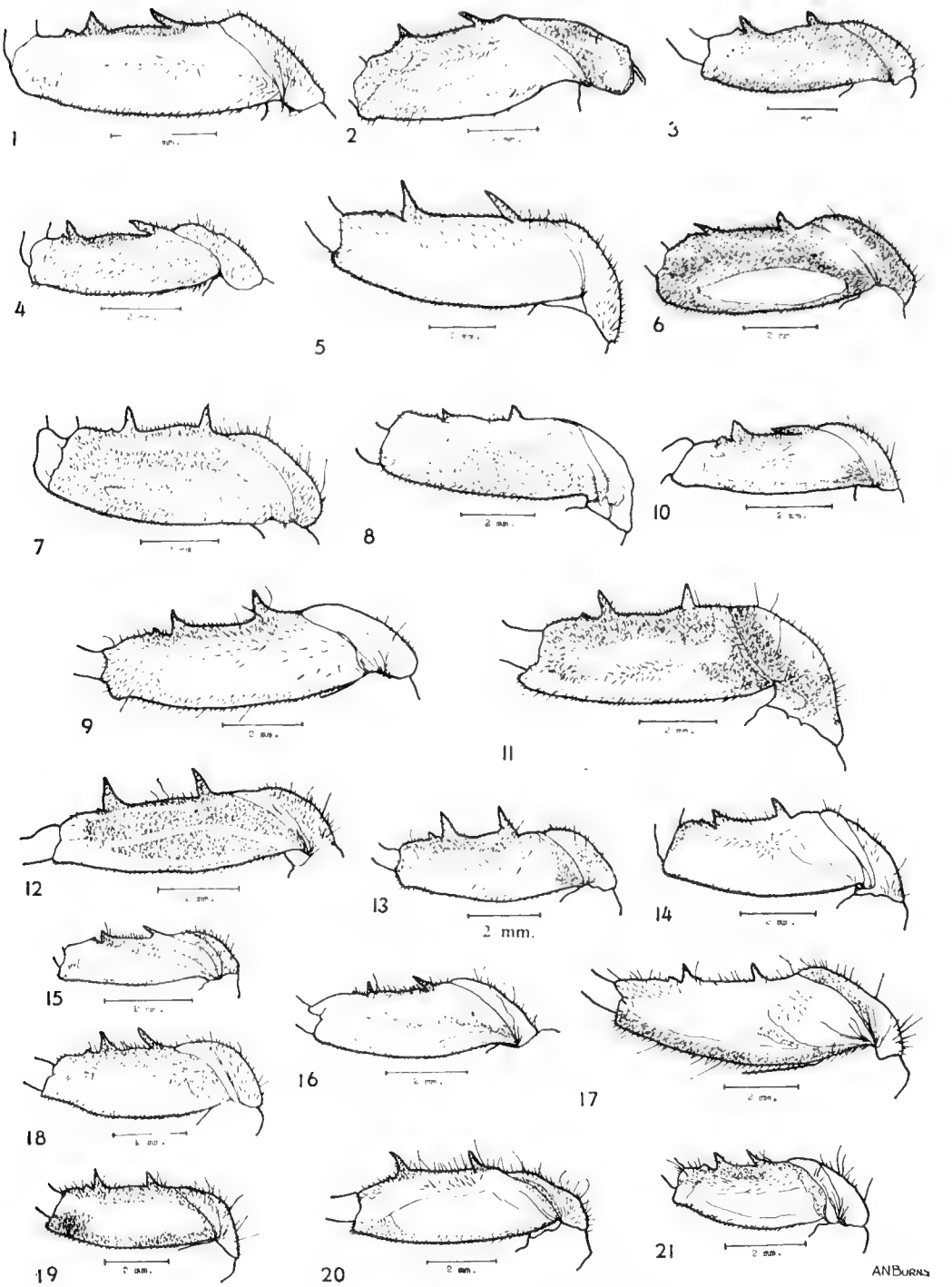


FIG. A.

Anterior Femora of Species of *Macrotristria*.

1. *Macrotristria angularis*. 2. *Macrotristria maculicollis*. 3. *Macrotristria hillieri*. 4. *Macrotristria occidentalis*. 5. *Macrotristria nanda*. 6. *Macrotristria kabikabia*. 7. *Macrotristria thophoides*. 8. *Macrotristria hieroglyphica*. 9. *Macrotristria godingi*. 10. *Macrotristria doddi*. 11. *Macrotristria sylvara*. 12. *Macrotristria nigrosignata*. 13. *Macrotristria frenchi* 14. *Macrotristria extrema*. 15. *Macrotristria vulpina*. 16. *Macrotristria dorsalis*. 17. *Macrotristria kulungura*. 18. *Macrotristria bindalia*. 19. *Macrotristria douglasi*. 20. *Macrotristria worora*. 21. *Macrotristria intersecta*.

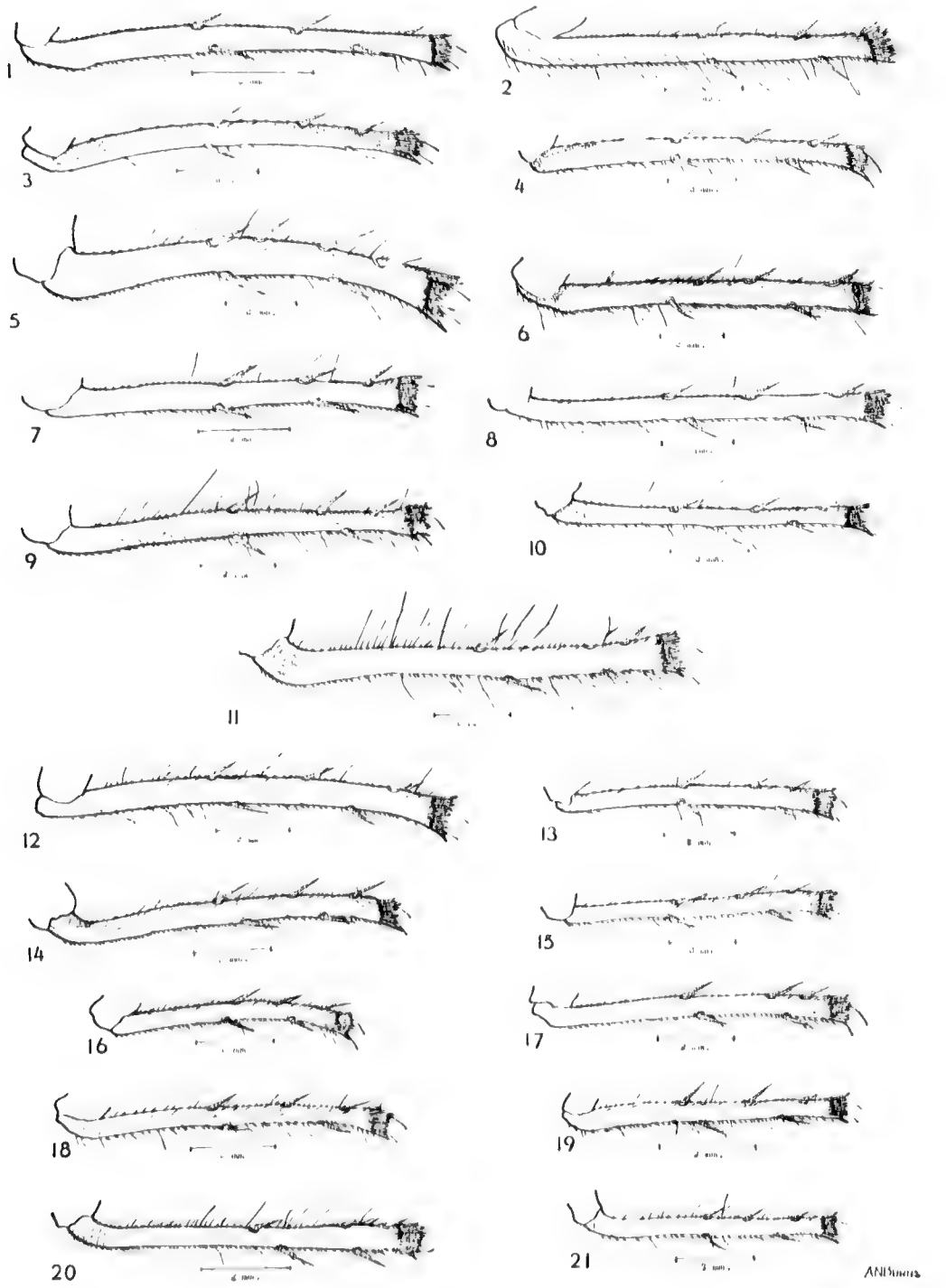


FIG. 13.

Posterior Tibiae of Species of *Macrotristria*.

1. *Macrotristria angularis*. 2. *Macrotristria maculicollis*. 3. *Macrotristria hillieri*. 4. *Macrotristria occidentalis*. 5. *Macrotristria nanda*. 6. *Macrotristria kabikabia*. 7. *Macrotristria thophoides*. 8. *Macrotristria hieroglyphica*. 9. *Macrotristria godingi*. 10. *Macrotristria doddi*. 11. *Macrotristria sylvara*. 12. *Macrotristria nigrosignata*. 13. *Macrotristria frenchi* 14. *Macrotristria extrema*. 15. *Macrotristria vulpina*. 16. *Macrotristria dorsalis*. 17. *Macrotristria kulungura*. 18. *Macrotristria bindalia*. 19. *Macrotristria douglasi*. 20. *Macrotristria worora*. 21. *Macrotristria intersecta*.

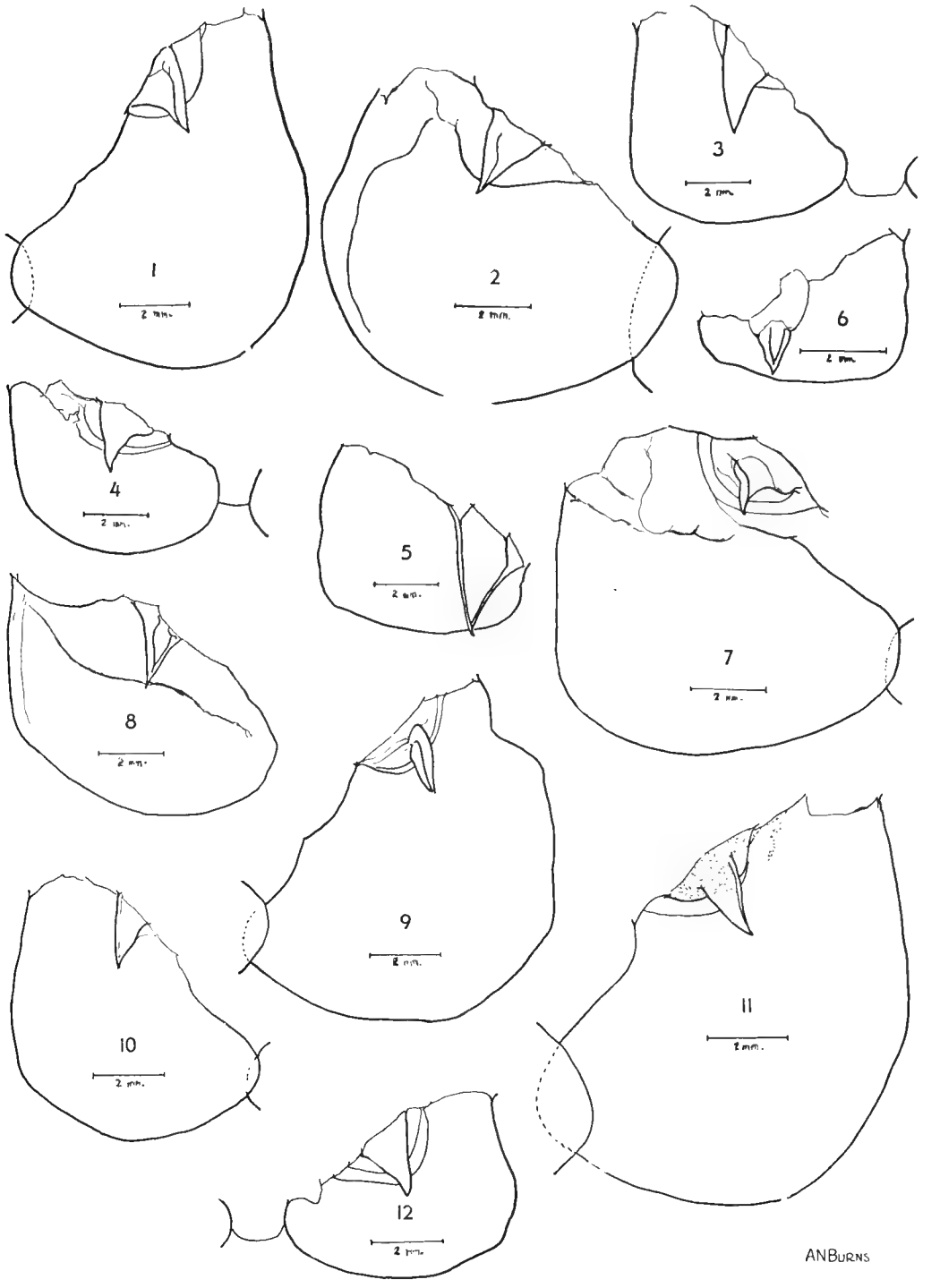


FIG. C.

Opercula of Species of *Macrotristria*.

1. *Macrotristria angularis*. 2. *Macrotristria maculicollis*. 3. *Macrotristria hillieri*. 4. *Macrotristria occidentalis*. 5. *Macrotristria nanda*. 6. *Macrotristria kabikabia*. 7. *Macrotristria thophoides*. 8. *Macrotristria hieroglyphica*. 9. *Macrotristria godingi*. 10. *Macrotristria doddi*. 11. *Macrotristria sylvara*. 12. *Macrotristria nigrosignata*.

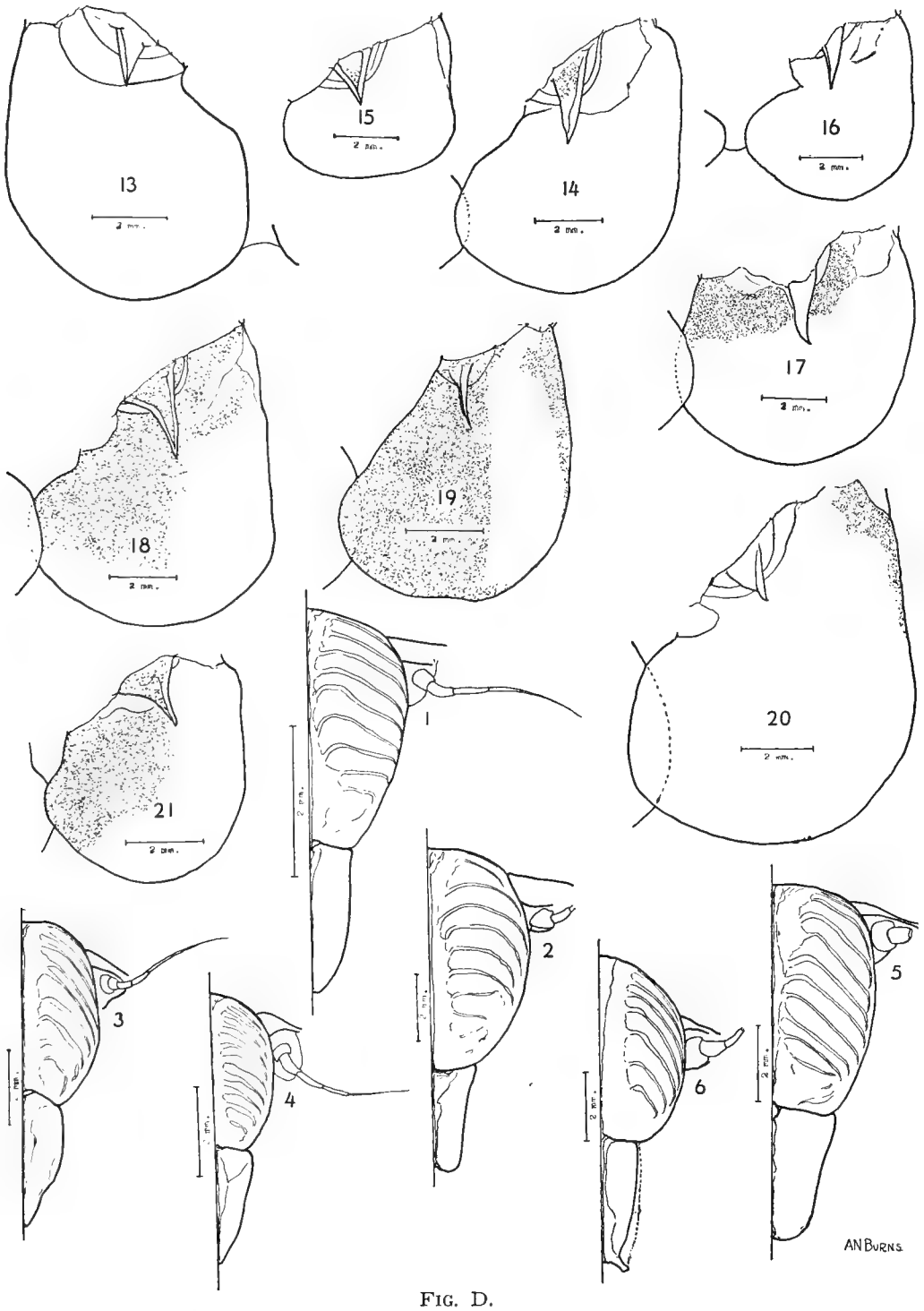


FIG. D.

Opercula and Frons of Species of *Macrotristria*.

Opercula.

13. *Macrotristria frenchi.* 14. *Macrotristria extrema.* 15. *Macrotristria vulpina.* 16. *Macrotristria dorsalis.* 17. *Macrotristria kulungura.* 18. *Macrotristria bindalia.* 19. *Macrotristria douglasi.* 20. *Macrotristria worora.* 21. *Macrotristria intersecta.*

Frons.

1. *Macrotristria angularis.* 2. *Macrotristria maculicollis.* 3. *Macrotristria hillieri.* 4. *Macrotristria occidentalis.* 5. *Macrotristria nanda.* 6. *Macrotristria kabikabia.*

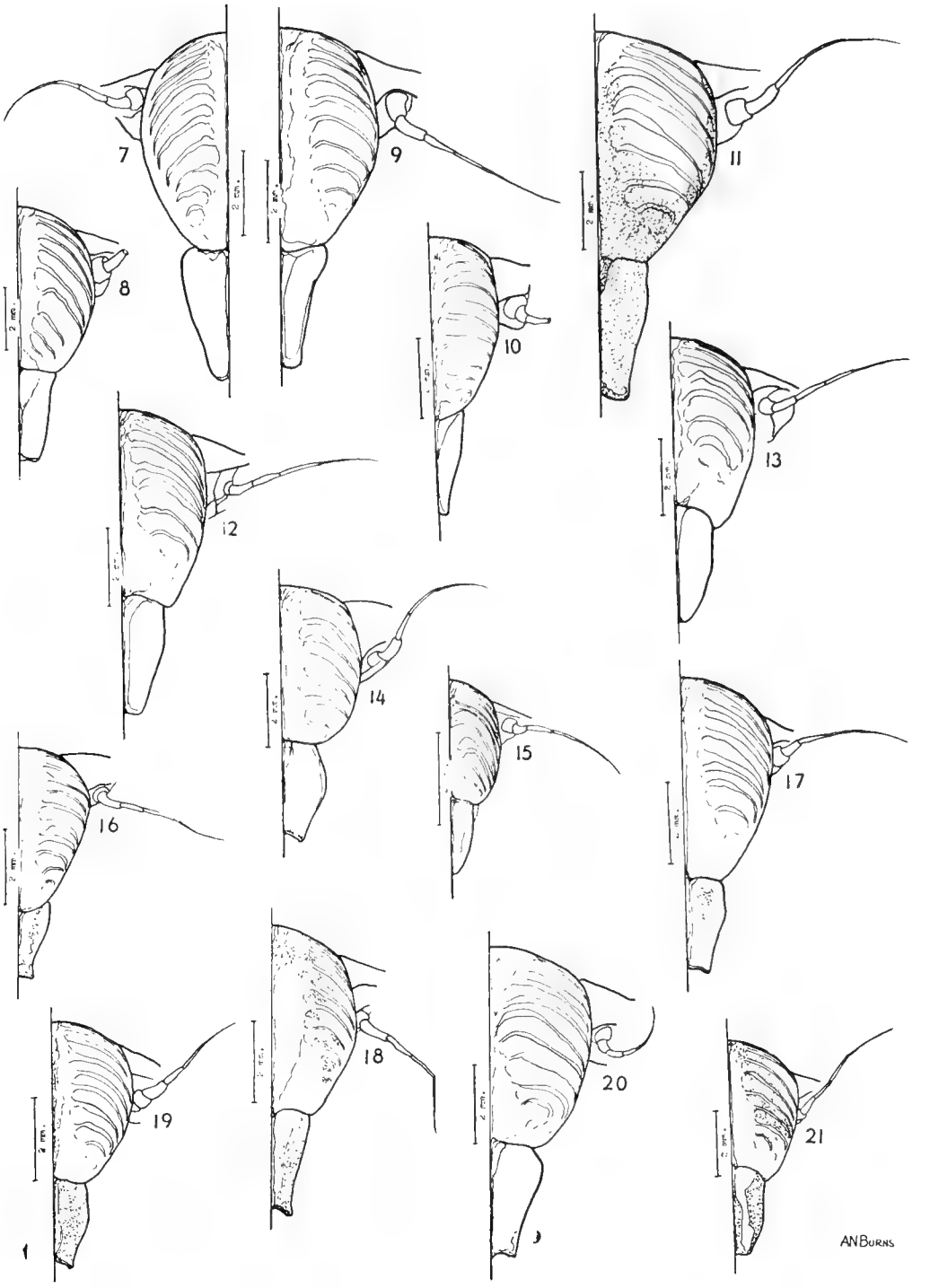


FIG. E.

Frons of Species of *Macrotristria.*

7. *Macrotristria thophoides.* 8. *Macrotristria hieroglyphica.* 9. *Macrotristria godingi.* 10. *Macrotristria doddi.* 11. *Macrotristria sylvara.* 12. *Macrotristria nigrosignata.* 13. *Macrotristria frenchi.* 14. *Macrotristria extrema.* 15. *Macrotristria vulpina.* 16. *Macrotristria dorsalis.* 17. *Macrotristria kulungura.* 18. *Macrotristria bindalia.* 19. *Macrotristria douglasi.* 20. *Macrotristria worora.* 21. *Macrotristria intersecta.*

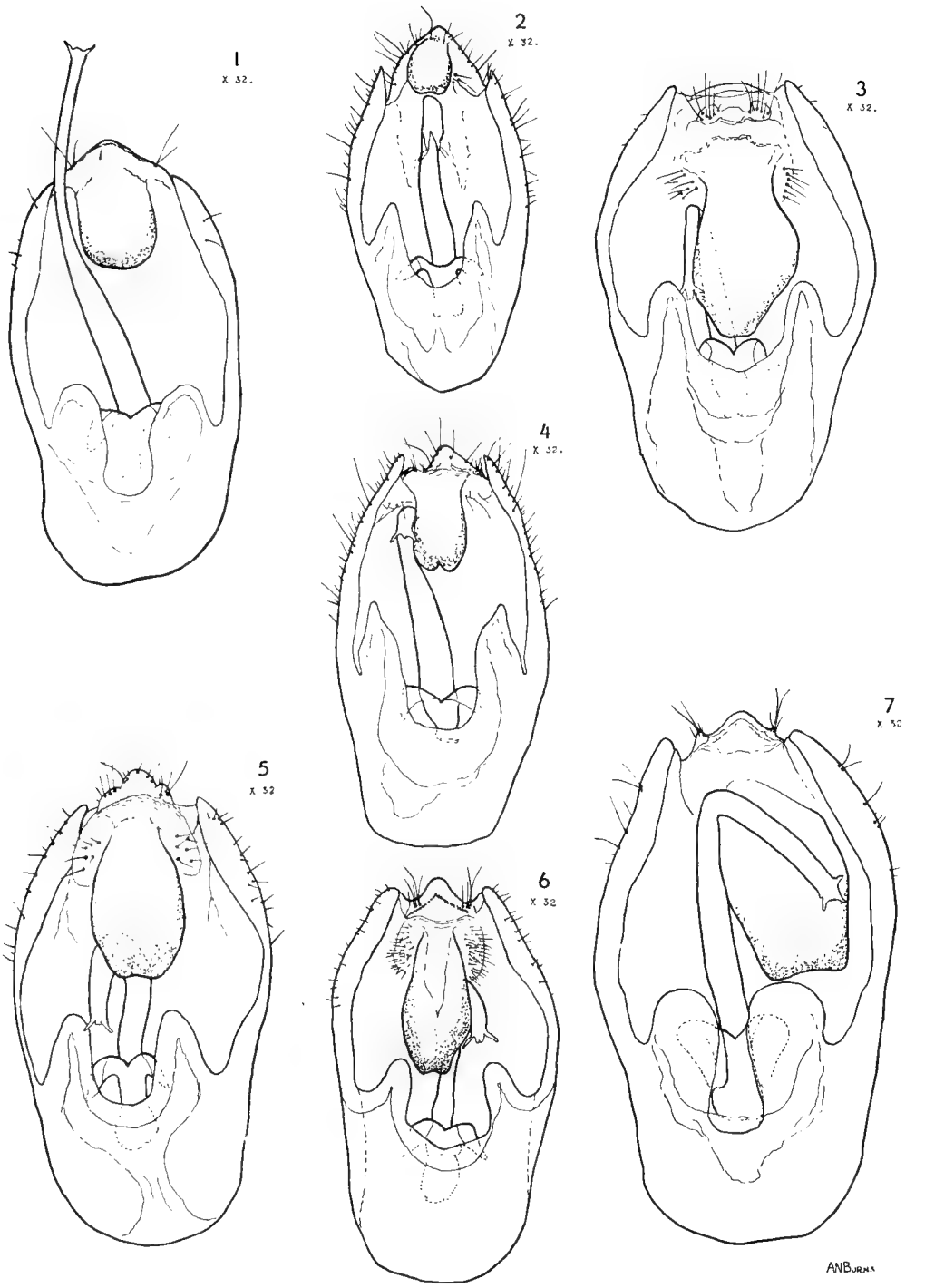


FIG. F.

Male Genitalia of Species of *Macrotristria*.

1. *Macrotristria dorsalis*. 2. *Macrotristria douglasi*. 3. *Macrotristria extrema*. 4. *Macrotristria worora*. 5. *Macrotristria bindalia*. 6. *Macrotristria intersecta*. 7. *Macrotristria kulungura*.

SUMMARY OF ENTOMOLOGICAL WORK OF C. G. OKE, WITH INFORMATION ON TYPES NOW INCLUDED IN THE NATIONAL MUSEUM OF VICTORIA COLLECTION.

By A. Neboiss, Acting Curator of Insects, National Museum of Victoria.

SUMMARY.

The main objective of this publication is to summarize the whereabouts of type specimens of species described by the late C. G. Oke, who in his papers indicated that the majority are in his collection. Shortly before death, he donated his collection to the National Museum of Victoria. It contained approximately 10,000 specimens of Coleoptera. The sorting of this collection occupied rather a long time, and even then it was not possible to locate all types, which according to publications, should be there.

INTRODUCTION.

A donation of a coleopterous collection, consisting of over 10,000 specimens was received by the National Museum of Victoria on December, 1958. It was presented by Mr. C. G. Oke, who was the assistant curator of insects in that institution for some years until his retirement in 1953.

The entire collection was housed in store-boxes, but due to the owners failing health was unfortunately somewhat neglected for the last two or three years. This counted for heavy insect pest infestation in some store-boxes causing serious damage to parts of the collection. The entire material appeared to be in process of sorting, with only small sections grouped and arranged in systematic order. A number of store-boxes were chaotic, specimens partly without locality labels, and of all imaginable families in haphazard arrangement. All these factors presented great difficulty in locating the type specimens, which moreover were not always indicated by appropriate label.

Following long and tedious work on this material it was possible to locate the majority of the type specimens which were known from publications as being in the collection. A small number has not yet been located, but probably may be found at some later date amongst unsorted and unlabelled material.

This publication contains information on all C. G. Oke's published entomological papers, together with a systematic and alphabetical list of species that he described. The latter includes full information of its original genus, family, literature reference, recorded localities and information of type specimens as well as the National Museum insect type registration number.

In his publications Mr. Oke described 22 new genera and 177 new species or varieties, and also designated and described eleven plesio-allotypes of species by King, Lea and Wilson. Three new generic names were proposed by Oke in 1951 (15) for praeoccupied names, *Rhizobiellus* to replace *Rhizobius* Agassiz (1846) non Burmeister (1835); *Pascoellus* to replace *Pephricus* Pascoe (1870) non Amyot & Serville (1843), and *Leptopius* to replace *Leptops* Schönherr (1833) non Rafinesque (1820). With regard this latter genus, it should be noted that Marshall 1952, Ann. Mag. Nat. Hist. (12) 5:265 proposed the name *Leptosus* to replace Schönherr's name, but publication by Oke has the priority.

PUBLICATIONS BY C. G. OKE.

1. A Day's Beetle Collecting at the Lerderderg, 1922, *Vict. Nat.* 38: 93–97.
2. An Entomologist in the Dandenongs in Winter. 1923, *Vict. Nat.* 39: 116–126.
3. Notes on the Victorian *Chlamydopsini* (*Coleoptera*), with Descriptions of New Species. 1923, *Vict. Nat.* 40: 152–162.
4. Notes on the Natya District. 1924, *Vict. Nat.* 41: 7–18.
5. New Australian *Coleoptera* (Part 1). 1925, *Vict. Nat.* 52: 6–15.
6. Notes on Beetle Larvae. 1925. *Vict. Nat.* 42: 15–17.
7. Two Entomologists in the Mallee. 1926, *Vict. Nat.* 42: 279–294.
8. Notes on Australian *Coleoptera*, with Descriptions of New Species (Part 1). 1928, *Proc. Linn. Soc. N.S.W.*, 53: 1–30.
9. On some Australian *Curculionoidae*. 1931, *Proc. roy. Soc. Vict.*, (N.S.) 43: 177–201.
10. Aculagnathidae—a New Family of *Coleoptera*. 1932, *Proc. roy. Soc. Vict.*, (N.S.) 44: 22–24.
11. Notes on Australian *Coleoptera*, with Descriptions of New Species (Part 2). 1932, *Proc. Linn. Soc. N.S.W.*, 57: 148–172.
12. Australian *Staphilinidae*. 1933, *Proc. roy. Soc. Vict.* (N.S.) 45: 101–136.
13. On some Australian *Curculionoidea*—Part 2. 1934, *Proc. roy. Soc. Vict.*, (N.S.) 46: 250–263.
14. Description of a New Species of Casemoth (*Lepidoptera* : *Psychidae*). 1947, *Mem. Nat. Mus. Vict.*, 15: 178–179.
15. The Coleoptera of the Russell Grimwade Expedition. 1915, *Mem. Nat. Mus. Vict.* 17: 19–25.
16. Australian Species of *Sphaeriidae* (*Coleoptera*). 1954, *Proc. roy. Soc. Vict.* 65: 57–59.
17. Fossil Insecta from Cainozoic Resin at Allandale, Victoria. 1957, *Proc. roy. Soc. Vict.* 69: 29–31.

SYSTEMATIC INDEX OF SPECIES DESCRIBED BY C. G. OKE.

(Unless stated otherwise.)

* — type species.
† — fossil.
(12) — Reference to publication as listed in bibliography.
‡ — type specimen not yet located.

Order Coleoptera.

Family *Rhysodidae*—
Rhysodes burnsi (11)

Family *Paussidae*—
Arthropterus abnormis (11)

Family *Carabidae*—
Xanthophoea pescotti (15)

Family *Sphaeridae*—
Neosphaerius coenensis (16)
**Neospraerius ovensensis* (16)

Family *Histeridae*—
Chlamydopsis ectatommae var. *rufomaculatus* (3)
Chlamydopsis leai (3)
Chlamydopsis pygidialis var. minor (3)
Chlamydopsis puncticollis (3)
Chlamydopsis sculptus (3)
Chlamydopsis setipennis (3)
Chlamydopsis strigicollis (3)
Orectoscelis bifovaecollis (3)

Family *Staphylinidae*—
Amblyoponiphilus agilis (12)
**Amblyoponiphilus satelles* (12)
Austroesthethus gippsensis (12)
**Austroesthethus passerculus* (12)
Austroesthethus punctatus (12)
Bledius australis (12)
Bledius militaris (12)
Bledius victoriae (12)
Calodera myrmeciae (12)
Conosoma hattahense (12)
Conosoma pictum (12)
**Coptotermoecia alutacia* (12)
Dabra sulcicollis (8)
Dabrasoma subopacum (12)
Edaphellus melculus (12)
Edaphellus melculus var. camponoti (12)
**Geosthethus attenuatus* (12)
Hetairotermes formicicola (12)
Holotrochus australicus (12)
Hyperomma atrum (8)
Hyperomma pallipes (8)
Hyperomma polypunctum (12)
Leucocraspedum ferrugineum (12)
Macrodicax latebricola (12)
Medon reticulatus (12)
**Microtachyporus imbricatus* (12)

Family *Staphylinidae*—continued.
‡*Microtachyporus linearis* (12)
‡*Oedichirus pictipes* (12)
Osorius victoriae (12)
Oxytelus dixoni (12)
Quedius belgravensis (8)
‡*Quedius marginalis* (12)
‡*Quedius vagans* (12)
Procirrus ferrugineus Lea (8)
Scimbalium nitidum (12)
Scopaeus gracilis (12)
Scopaeus testaceipes Lea (12)
Suniopsis cribripennis Lea (8)
Thyreocephalus caeruleus (12)
**Warburtonia inflatipes* (12)
Warburtonia rufipes (12)

Family *Pselaphidae*—
Articerus fimbriatus (8)
Articerus leai (8)
Batraxys trifoveata (8)
Batrisodes clavitarsis (11)
Batrisodes gracilicornis (11)
Bryaxis macquariensis (11)
**Chalcoplectus depressus* (5)
Clavigeropsis australiae Lea (8)
Eupines impedita (11)
Eupines nigella (8)
†*Eupines setifera* (17)
**Eupinion crassipes* (8)
Eupinoda fraterna (8)
**Eupinolus lucifugus* (8)
Eupinolus obscurus (8)
Eupinolus parasitus (8)
Eupinolus socialis (8)
Eupinopsis uniclavata (8)
Hamotopsis carinatus (11)
Limoniates cribratus (8)
Macroplectus tuberculatus (11)
**Malleecola myrmecophila* (8)
Narcodes crassus (5)
Narcodes squamosus (8)
Narcodes vulgaris (5)
**Neopalimbolus goudiei* (8)
Palimbolus excavicornis (11)
Palimbolus fasciculus (11)
Palimbolus postcoxalis (8)
Palimbolus rugosus (8)
Plectostenus orientalis (8)
Pselaphus alluvius (8)
Pselaphus electilis (8)
Pselaphus squamulosus (8)
Pselaphus sulciventris (8)
Rybaxis brevis (8)
Rybaxis delectabilis (8)
Rybaxis kingi (8)

Family *Pselaphidae* –continued.
Rybaxis leai (8)
Rybaxis melanocephala (8)
Rybaxis monstrabilis (8)
Rybaxis sternalis (5)
Rybaxis trochanteris (11)
Rybaxis vagus (11)
Sagola brevipennis (5)
Sagola filixicola (8)
Sagola formicicola (5)
Sagola foveicornis (11)
Sagola helenae (5)
Sagola rugicornis (11)
Sagola tricolor (8)
Sagola ventralis (8)
Sagola victoriae (5)
Tmesiphorus componoti (5)
Tyromorphus quadridentatus Lea (8)
Tyromorphus speciosus King (8)
Tyromorphus termitophilus (8)
Tyromorphus tibialis Wilson (8)

Family *Scarabaeidae* -
Aphodius dixoni (5)
Diphucephala dentipes (15)

Family *Byrrhidae* -
Pedilophorus comatus (11)

Family *Buprestidae* -
Stigmodera montigena (8)

Family *Ptinidae* -
**Bitrephes cuneiformis* (8)
Diplocotes crassicornis (11)
Diplocotes minuta (8)
Polyplocotes apicalis (8)
Polyplocotes similis (8)

Family *Aculagnathidae* -
**Aculagnathus mirabilis* (10)

Family *Cucujidae*—
Cryptomorpha lata (5)

Family *Endomychidae*—
Daulotypus umbratilis (11)

Family *Tenbrionidae* –
Cotulades pilosus (11)
Ennoboeus fossoris (11)
Ennoboeus tarsalis (11)
Omolipus grimwadei (15)
Paratoxicum nigricans (11)
Scirotrana burneti (11)

Family *Cerambycidae*—
Atesta besti (8)
Atesta dixoni (8)
Earinus variabilis (11)
Itheum robustum (11)
Itheum villosum (11)
Tritocosmia armata (11)

Family *Chrysomelidae*—
Arsipoda metallica (11)
Arsipoda montana (11)
**Austrolema vitinea* (11)
Brachycaulus minor (11)
Eugastromela abdominalis (11)
Eugastromela flavitarsis Lea (11)
Geomela gabrieli (11)
**Hyphalticoda caesita* (11))
Microdonacia terricola (11)
Monolepta jucunda (8)
Monolepta themedicola (8)
Neorupilla fusca (11)
Tomyris intermixta (11)

Family *Anthribidae*—
Allochromicis montanus (13)

Family *Belidae*—
Isacantha papulosa var. *nigra* (13)

Family *Ipidae*—
**Ipsocossonus anomalus* (13)

Family *Curculionidae*—
Belpardia panacis (9)
**Cisolea umbratilis* (13)
**Daylesfordia uvida* (9)
Diethusa setosa (9)
Diethusa venusta (9)
**Dixoncis pictus* (9)
Ecrizothis blackburnia (9)
Ecrizothis similis (9)
Ecrizothis terminalis (9)
Leptops nothus (9)
**Mandalotina atranotata* (9)
Mandalotina bicolor (9)
Mandalotina varia (9)
Mandalotus acanthocnemis Lea (9)
Mandalotus bryophilus (9)
Mandalotus egenus (9)
Mandalotus exilis (13)
Mandalotus explanicollis (9)
Mandalotus graminicola (9)
Mandalotus impressicollis (9)
Mandalotus leai (9)
Mandalotus lucaris (13)
Mandalotus luciphilus (13)
‡*Mandalotus macrops* Lea (9)
Mandalotus minusculus (13)
Mandalotus obliquus (13)
Mandalotus octagonalis (9)
Mandalotus pentagonoderes Lea (9)
**Nyella tuberculata* (9)
Phrynixus major (9)
Phrynixus sylvicola (9)
Phrynixus victoriae (9)
Polyphrades viridis (9)
Rhadinosomus parvus (13)
Rhinoncus australis (9)

Order Lepidoptera.

Family *Psychidae*—
Plutorectis caespitosae (14)

ALPHABETICAL INDEX OF SPECIES DESCRIBED BY C. G. OKE.

abdominalis Oke

Eugastromela Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 167.
Hab.—Vic.: Whittlesea, Killara, Warburton.

Type ♂—838, "Whittlesea, Vic., 9 Nov. 1908, C. Oke". Type ♀—839, "Killara, Vic., 27 Nov. 1921, C. Oke".

abnormis Oke

Arthropterus Family Paussidae.
1932, Proc. Linn. Soc. N.S.W., 57: 149, fig. 2.
Hab.—Vic.: Riddell.

Type (sex?)—570, "Riddell, Vic., 1 Jan. 1927, C. Oke".

acanthocnemis Lea

Mandalotus Family Curculionidae.
1929, Proc. Linn. Soc. N.S.W., 54: 531 (Lea).
1931, Proc. Roy. Soc. Vic., 181, fig. 3e (Oke).
Hab.—S.A.; Vic.

Allotype ♀ (Plesioallotype)—793, "Eltham, Vic., C. Oke", marked "A" on one card with one ♂. *M. acanthocnemis* Lea is now synonym of *Mandalotus hoplocnemus* Lea.

agilis Oke

Amblyoponiphilus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 134, fig. 92.
Hab.—Vic.: Ferntree Gully, Belgrave, Macedon, Ballarat.

Type (sex?)—1336. "Belgrave, Vic., 2 Jul. 1921, C. Oke".

alluvius Oke

Pselaphus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 16.
Hab.—Vic.: Bendigo.

Type ♀—1155, "Bendigo, Vic., 10 Oct. 1925, C. Oke".

alutacia Oke (type species)

Coptotermoecia Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 136, figs. 48, 84, 88.
Hab.—Vic.: Natya, Violet Town.

Type ♂—1315; type ♀—1316 (on one card); "Violet Town, Vic. July 1924. C. Oke. In nests of *Coptotermes acinaciformis* Frogg. Id. G. F. Hill". Paratypes ♀—1317, 1318; (data as for type).

anomalus Oke (type species)

Ipsocossonus Family Ipidae.
1934, Proc. roy. Soc. Vict., 46: 251, figs. 1–7.
Hab.—Vic.: Violet Town.

Type (sex?)—1279, "Violet Town, Vic., C. Oke".

apicalis Oke

Polyplocotes Family Ptinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 26.
Hab.—Vic.: Hattah.

Type (sex?)—588. Paratype (sex?)—589, 590 (on one card); "Hattah, Vic., Nov. 1924, C. Oke". Type marked "T".

armata Oke

Tritocosmia Family Cerambycidae.
1932, Proc. Linn. Soc. N.S.W., 57: 162.
Hab.—Vic.: Launching Place, Warburton.

Type ♀—1244, "Launching Place, Vic., C. Oke". Type ♂—1243, "Warburton district, Vic." Paratype ♂—1245 (no locality). Paratype ♀—1246, "Warburton district, Vic., 15 Jan. 1923". Paratype ♀—1247 (no locality). Paratype (sex?)—1347 (no locality).

atra Oke—see *atrum* Oke.

atranotata Oke (type species)

Mandalotina Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 190, figs. 3 j, k, l.
Hab.—Vic.: Belgrave, Warburton, Lorne.

Type—(not located). Paratypes (3 ♂ 2 ♀)—867–871, "Warburton, Vic., Apr. 1929, C. Oke" (on one card).

atrum Oke

Hyperomma Family Staphylinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 3.
1933, Proc. Roy. Soc. Vict., 45: 119, fig. 73.
Hab.—Vic.: Carrum.

Type ♂—1233, "Carrum, Vic., Jul. 1927, C. Oke". Allotype ♀ (Plesioallotype)—1234, "Carrum, Vic., Aug., 1928, C. Oke". Originally described as *atra,* 1933 changed to *atrum,* and described ♀, which is badly damaged by insect pests, only thorax and part of abdomen remains.

attenuatus Oke (type species)

Geosthethus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 111, figs. 33–40, 56.
Hab.—Vic.: Belgrave, Warburton.

Type (sex?)—1321, "Belgrave, Vic., 19 Apr. 1927, C. Oke".

australiae Lea

Clavigeropsis Family Pselaphidae.
1910, Proc. roy. Soc. Vict., 23: 175 (Lea).
1928, Proc. Linn. Soc. N.S.W., 53: 23 (Oke).
(*Clavergeropsis*—misspelling by Oke.)
Hab.—N.S.W. (Lea); Vic.: Pakenham.

Allotype ♂ (Plesioallotype)—2670, "Pakenham, Vic., 25 Dec. 1922, C. Oke" marked "T" on one card with another ♂.

australicus Oke

Holotrochus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 101, figs. 1–5, 41.
Hab.—Vic.: Gembrook, Belgrave.

Type (sex?)—1313, " Gembrook, Vic., June 1927, C. Oke ". Paratype (sex?)—1314, " Belgrave, Vic., C. Oke ". Paratype (sex?)—1319, " Gembrook, Vic ".

australis Oke

Bledius Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: figs. 66, 67.
Hab.—Vic.: Caulfield, Emerald, Warburton.

Type ♂—1322. Type ♀—1324. Paratype ♂—1323. Paratype ♀—1325, " Caulfield, Vic., 13 Feb. 1925, C. Oke ". (All on one card.) Type ♂ marked " T ", type ♀ marked " A ". Legend for figs. 66 and 67 on page 117 reads " *Bledius victoriae* n.sp." and according to International Rules of Zoological Nomenclature constitutes a synonym.

australis Oke

Rhinoncus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 198.
Hab.—Vic.: Natya, Kerang.

Type ♂—613. Type ♀—614. No locality labels attached to the specimens (both on one card).

belgravensis Oke

Quedius Family Staphylinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 1.
Hab.—Vic.: Belgrave.

Type ♂—1219, " Belgrave, Vic., 3 Jul. 1921, C. Oke ".

besti Oke

Atesta Family Cerambycidae.
1928, Proc. Linn. Soc. N.S.W., 53: 28.
Hab.—Vic.: Gypsum.

Type ♀—1259, " Gypsum, Vic., Nov. 1924, C. Oke ".

bicolor Oke

Mandalotina Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 191.
Hab.—Vic.: Warburton.

Type (sex?)—866, " Warburton, Victoria, C. Oke ".

bifovaecollis Oke

Orectoscelis Family Histeridae.
1923, Vict. Nat. 40: 159.
Hab.—Vic.: Natya.

Type (sex?)—904, " Natya, Vic., 29 Sept. 1922, C. Oke ".

blackburni Oke

Ecrizothis Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 178.
Hab.—Vic.: Macedon.

Type (sex?)—877, " Macedon, Vic., C. Oke ".

brevipennis Oke

Sagola Family Pselaphidae.
1925, Vict. Nat., 42: 8.
Hab.—Vic.: Belgrave.

Type ♂—1063, " Belgrave, Vic., 2 Jul. 1921, C. Oke ".

brevis Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 9.
Hab.—Vic.: Warburton, Belgrave.

Type ♂—929. Type ♀—931. Paratype ♂—930. Paratype ♀—932 (all on one card), " Warburton, Vic., 27 Dec. 1925, C. Oke ". Type ♂ marked " T ", type ♀ marked " A ".

bryophilus Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 186, fig. 3c.
Hab.—Vic.: Lorne.

Type ♂—713, type ♀—714, (on one card), " Lorne, Vic., C. Oke ". Paratype ♂—715, " Lorne, Vic., C. Oke ".

burneti Oke

Seirotrana Family Tenebrionidae.
1932, Proc. Linn. Soc. N.S.W., 57: 160, fig. 14.
Hab.:—Vic.: Traralgon.

Type ♂—1299, type ♀—1300 (on one card), " Traralgon, Vic., C. Oke ". ♀ badly damaged by insect pests; head, part of prothorax and some legs missing.

burnsi Oke

Rhysodes Family Rhsodidae.
1932, Proc. Linn. Soc. N.S.W., 57: 148, fig. 1.
Hab.—N.S.W.: Mt. Wilson.

Type (sex?)—520, " Mt. Wilson, N.S.W., 4 Jan. 1931, C. Oke ".

caeruleus Oke

Thyreocephalus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 126.
Hab.—Vic.: Hattah, Melton, Sunshine.

Type ♂—1337, paratype ♂—1338 (on one card), " Melton, Vic., 24 May 1924, C. Oke ". Type ♀—1339, paratype ♀—1340 (on one card), " Melton, Vic., 24 May 1924, C. Oke ". Paratype (sex?)—1341, " Lake Hattah, Vic., Nov. 1924, C. Oke ".

caesita Oke (type species)

Hyphalticoda Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 171, fig. 25.
Hab.—Vic.: Frankston.

Type ♂—1281, type ♀—1282 (on one card), "Frankston, Vic., C. Oke".

caespitosae Oke

Plutorectis Family Psychidae (Lepidoptera).
1947, Mem. Nat. Mus. Vict., 15: 178, pl. 15, figs. 1–8.
Hab.—Vic.: Bogong High Plains, Mt. Hotham; N.S.W.: Mt. Kosciusco.

Type ♂—555, allotype ♀—556, 2 paratypes ♂—557, 558, "Bogong High Plains, Vic., Jan. 1947, Miss L. White".

camponoti (var.) Oke

Edaphellus melculus Oke var. Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 111.
Hab.—Vic.: Ferntree Gully, Evelyn, Lilydale.

Type (sex?)—1309, "Evelyn, Vic., 3 June 1922, C. Oke". Paratype (sex?)—1310, "Lilydale, Vic., 1 Jul. 1928, C. Oke". (See note under *melculus* Oke.)

camponoti Oke

Tmesiphorus Family Pselaphidae.
1925, Vict. Nat., 42: 12.
Hab.—Vic.: Lake Hattah.

Type ♂ 1073, type ♀—1074 (on one card), "Lake Hattah, Vic., Nov. 1924, C. Oke".

carinatus Oke

Hamotopsis Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 157.
Hab.—N.S.W.: Dorrigo.

Type ♀—581, "Dorrigo, N.S.W., C. Oke".

clavitarsis Oke

Batrisodes Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 152, figs. 5–7.
Hab.—N.S.W.: Dorrigo.

Type ♂—1083, 2 paratypes ♂—1084, 1085 (on one card), "Dorrigo, N.S.W., C. Oke". Type marked "T". Described from 5 ♂ and 1 ♀ believed to be this species. Only the above 3 ♂ were located.

coenensis Oke

Neosphaerius Family Sphaeridae.
1954, Proc. roy. Soc. Vict., 65: 59.
Hab.—Qld.: Coen.

Type (sex?)—835, "Coen, North Qld., 18 May 1951, C. Oke".

comatus Oke

Pedilophorus Family Byrrhidae.
1932, Proc. Linn. Soc. N.S.W., 57: 158.
Hab.—Vic.: Bacchus Marsh, Anakies, You Yangs, Mt. Blowhard.

Type (sex?)—1552, "Bacchus Marsh, Vic., C. Oke". Paratypes (sex?)—1301–1302 (on one card), "Anakies, Vic., Dec. 1927, C. Oke". Paratypes (sex?)—1303, "Anakie Range, Vic., 26 Dec. 1927, E. Nye". Paratypes (sex?)—1550–1551 (on one card) no locality.

crassicornis Oke

Diplocotes Family Ptinidae.
1932, Proc. Linn. Soc. N.S.W., 57: 161.
Hab.—Vic.: Hattah.

Type (sex?)—593, 2 paratypes (sex?)—592, 594 (on one card), "Hattah, Vic., Sept. 1927, C. Oke". Type marked "T".

crassipes Oke (type species)

Eupinion Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 14.
Hab.—Vic.: Noble Park.

Type ♀—1147, type ♂—1148 (on one card), "Noble Park, Vic., 4 Oct. 1924, C. Oke". Paratype ♀—1149, paratype ♂—1150 (on one card), same data as for types.

crassus Oke

Narcodes Family Pselaphidae.
1925, Vict. Nat., 42: 10.
Hab.—Vic.: Grampians.

Type ♀—1066, type ♂—1067 (on one card), "Grampians, Vic., Nov. 1924, C. Oke". Paratype ♀—1068 (data as for types).

cribratus Oke

Limoniates Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 5.
Hab.—Vic.: Frankston.

Type ♂—1117, type ♀—1118, 2 paratypes—♂—1119, ♀ 1120 (all on one card), "Frankston, Vic., 14 Feb. 1926, C. Oke". Type ♂ and ♀ marked "T".

cribripennis Lea

Suniopsis Family Staphilinidae.
1922, Trans. roy. Soc. S.A., 47: 37 (Lea).
1928, Proc. Linn. Soc. N.S.W., 53: 2 (Oke).
Hab.—Vic.: Ferntree Gully, Belgrave, Evelyn, Emerald, Warburton.

Allotype ♂ (Plesioallotype)—1232, "Emerald, Vic., Nov. 1919, C. Oke".

cuneiformis Oke (type species)

Bitrephes Family Ptinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 27.
1926, Vict. Nat., 42: 291 (few distinguishing characters and MSS name).
Hab.—Vic.: Lake Hattah.

Type (sex?)—584, 2 paratypes—582, 583, 585 (on one card), "Hattah, Vic., Nov. 1924, C. Oke"; 2 paratypes—586, 587 (on one card), 2 paratypes—2643, 2644 (on one card), and paratype—2645 (all with same data as for type).

delectabilis Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 8.
Hab.—Vic.: Carrum, Frankston.

Type ♂—921, type ♀—923, 2 paratypes ♂—922, ♀—924 (on one card) "Carrum, Vic., July 1927, C. Oke". Type ♂ marked "T", type ♀ marked "A". Paratypes 2 ♂ 2 ♀—925—928 (on one card), "Frankston, Vic., July 1927, C. Oke", 2 paratypes ♂—2641, ♀—2642 (on one card) "Frankston, Vic., C. Oke".

dentipes Oke

Diphucephala Family Scarabaeidae.
1951, Mem. Nat. Mus. Vict., 17: 22.
Hab.—W.A.

Holotype ♂—1198, allotype ♀—1199, paratype ♂—1200, "Pimelea, W.A., 7 Sept. 1947, R. T. M. Pescott".

depressus Oke (type species)

Chalcoplectus Family Pselaphidae.
1925, Vict. Nat. 42: 14.
Hab.—Vic.: Belgrave, Evelyn, Bacchus Marsh, Coburg, Ferntree Gully, Mitcham, Mooroolbark.

Type ♂—1075, type ♀—1076 (on one card), "Evelyn, Vic., 5 June 1922, C. Oke". Paratypes 2 ♂ 2 ♀—1077—1080 (on one card); data as for type.

dixoni Oke

Aphodius Family Scarabaeidae.
1925, Vict. Nat., 42: 6.
Hab.—Vic.: Lake Hattah.

Type ♂—618; type ♀—619, (on one card), "Lake Hattah, Vic., Nov. 1924, C. Oke".

dixoni Oke

Atesta Family Cerambycidae.
1928, Proc. Linn. Soc. N.S.W., 53: 28.
Hab.—Vic.: Lake Hattah.

Type ♂—1248; type ♀—1249. "Hattah, Vic., C. Oke"; 2 paratypes—1250–1251 (on one card) "Lake Hattah, Vic., Dec. 1919".

dixoni Oke

Oxytelus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 108.
Hab.—Vic.: Emerald.

Type ♂—1223; type ♀—1225; paratypes ♂—1224, ♀—1226 (on one card) "Emerald, Vic., 16 Aug. 1925, C. Oke". Paratypes ♂ ♀ 1556-1557 (on one card) "Emerald, Vic., 7 Sept. 1925, C. Oke".

egenus Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 190.
Hab.—Vic.: Belgrave, Ferntree Gully.

Type ♂ 608, type ♀ 609, 2 paratypes—610—611 (on one card) "Belgrave, Vic., 10 Apr. 1927, C. Oke". Type ♂ marked "H", type ♀ marked "A".

electilis Oke

Pselaphus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 16.
Hab.—Vic.: Pakenham, Belgrave.

Type ♂—1157; type ♀—1158, 2 paratypes—1156, 1159 (on one card), "Pakenham, Vic., C. Oke". Type ♂ and ♀ marked "T".

excavicornis Oke

Palimbolus Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 156.
Hab.—Vic.: Lorne.

Type ♂—1104; type ♀ 1105, 2 paratypes ♀ 1106—1107 (on one card), "Lorne, Vic. C. Oke". Type ♂ and ♀ marked thus "↑"; paratype ♀—1108, "Lorne, Vic., C. Oke".

exilis Oke

Mandalotus Family Curculionidae.
1934, Proc. roy. Soc. Vict., 46: 258, figs. 15, 16, 23.
Hab.—Vic.: Bendigo, Castlemaine.

Type ♂—722, type ♀—723, paratype ♀—724 (on one card), "Bendigo, Vic., 4 Oct. 1931, C. Oke". Type ♂ marked "Ty", type ♀ marked "Al".

explanicollis Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 187, fig. 4b.
Hab.—Vic.: Lorne.

Type ♂—721 "Lorne, Vic., O. Oke".

fasciculus Oke

Palimbolus Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 155.
Hab.—N.S.W.: Dorrigo.

Type (sex?)—1304, paratype (sex?)—1305 (on one card) without locality. Type marked "T".

ferrugineum Oke

Leucocraspedum Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 129.
Hab.: Vic.: Hattah.

Type ♂—1344, type ♀—1345 (on one card), "Hattah, Vic., C. Oke".

ferrugineus Lea

Procirrus Family Staphylinidae.
1922, Trans. roy. Soc. S.A., 47: 10 (Lea).
1928, Proc. Linn. Soc. N.S.W., 53: 2 (Oke).
Hab.—Vic.: Caulfield, Coburg, Sunshine.

Allotype ♂ (Plesioallotype)—1241, "Coburg, Vic., 6 June 1920, C. Oke".

filixicola Oke

Sagola Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 4.
Hab.—Vic.: Gembrook.

Type ♂—1115, "Gembrook, Vic., 6 June 1927, C. Oke".

fimbriatus Oke

Articerus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 24.
Hab.—N.S.W.: Glen Innes.

Type ♂—940, paratype ♂—941 (on one card), "Glen Innes, N.S.W., W. du Boulay". Type marked "T".

flavitarsis Lea

Eugastromela Family Chrysomelidae.
1929, Trans. roy. Soc. S.A., 53: 238 (Lea).
1932, Proc. Linn. Soc. N.S.W., 57: 167, fig. 21 (Oke).
Hab.—Vic.: Ringwood, Belgrave, Gembrook, Traralgon, Moe.

Allotype ♂ (Plesioallotype)—840, "Belgrave, Vic., C. Oke". ♂ and ♀ on one card; ♂ marked "T".

formicicola Oke

Hetairotermes Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 135.
Hab.—Vic.: Gypsum.

Type (sex?)—1218, "Gypsum, Vic., Nov. 1926, C. Oke".

formicicola Oke

Sagola Family Pselaphidae.
1925, Vict. Nat., 42: 8.
Hab.—Vic.: Ferntree Gully.

Type ♂—1064, type ♀—1065 (on one card), "Ferntree Gully, Vic., 20 June 1920, C. Oke".

fossoris Oke

Enneboeus Family Tenebrionidae.
1932, Proc. Linn. Soc. N.S.W., 57: 159, fig. 11.
Hab.—Vic.: Bendigo.

Type (sex?)—1207, "Bendigo, Vic., 10 Oct. 1925, C. Oke".

foveicornis Oke

Sagola Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 151, fig. 4.
Hab.—N.S.W.: Dorrigo.

Type ♂—1082, "Dorrigo, N.S.W., C. Oke".

fraterna Oke

Eupinoda Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 13.
Hab.—Vic.: Belgrave.

Type ♂—2659, type ♀—2660, paratypes ♂—2661, ♀—2662 (on one card), type ♂ marked "T", type ♀ marked "A", "Ferntree Gully, Vic., 14 Aug. 1921, C. Oke"; re-discrepancy in locality see note under *monstrabilis*.

fusca Oke

Neorupilla Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 169, fig. 22.
Hab.—Vic.: Belgrave.

Type ♂—1283, type ♀—1284 (on one card), "Belgrave, Vic., C. Oke".

gabrieli Oke

Geomela Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 168.
Hab.—Vic.: Lorne.

Type (sex?)—2519, paratypes 2520–2523 (5 specimens on one card). (Type 4th in a row marked "Ty".) Paratypes 2524–2526 (on one card), "Lorne, Vic., C. Oke".

gippsensis Oke

Austroesthethus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 114, fig. 55.
Hab.—Vic.: Pakenham, Traralgon.

Type (sex?)—1329, "Pakenham, Vic., 21 Sept. 1925, C. Oke".

goudiei Oke (type species)

Neopalimbolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 22.
Hab.—Vic.: Sea Lake, Gypsum.

Type ♂—1192, type ♀—1193, paratype ♂—1191 (on one card), "Gypsum, Vic., Nov. 1924, C. Oke". Type ♂ and ♀ marked "Types".

gracilicornis Oke

Batrisodes Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 153.

This name proposed by Oke replaces *B. tenuicornis* Lea 1910, not Raffray, 1904.

gracilis Oke

Scopaeus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 116.
Hab.—Vic.: Pakenham.

Type ♂—1235, type ♀—1237, paratypes ♂—1236, ♀ 1238, (on one card), "Pakenham, Vic., 20 Oct. 1925, C. Oke". Paratype (sex?)—1308, "Pakenham, Vic., Sept. 1925, C. Oke".

gramincola Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 186.
Hab.—Vic.: Belgrave, Warburton, Emerald.

Type ♂—730, type ♀—731, paratypes 2 ♂ 1 ♀—732–734 (on one card), "Belgrave, Vic., C. Oke". Type ♂ marked "T", type ♀ marked "A". Paratypes (sex?)—735–736, "Emerald, Vic., C. Oke".

grimwadei Oke

Omolipus Family Tenebrionidae.
1951, Mem. Nat. Mus. Vict., 17: 22.
Hab.—W.A.: Denmark.

Holotype ♀—1201, "Pimelea, W.A., 7 Sept. 1947, R. T. M. Pescott". The published locality "Denmark" is erroneous.

hattahense Oke

Conosoma Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 127.
Hab.—Vic.: Hattah.

Type (sex?)—1554, paratype—1555 (on one card), "Hattah, Vic., C. Oke". Paratypes (sex?)—1326–27, "Lake Hattah, Vic., Apr. 1919".

helenae Oke

Sagola Family Pselaphidae.
1925, Vict. Nat., 42: 7.
Hab.—Vic.: Evelyn.

Type ♂—1059, "Evelyn, Vic., 5 June 1922, C. Oke".

imbricatus Oke (type species)

Microtachyporus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 128, figs. 60, 61, 78–83.
Hab.—Vic.: Ferntree Gully, Belgrave, Warburton.

Type (sex?—2883, paratype (sex?)—2884 (on one card), "Ferntree Gully, Vic., 16 Feb. 1922, C Oke" type marked "T".

impedita Oke

Eupines Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 154, figs. 8, 9.
Hab.—Vic.: Warburton, Frankston.

Type ♂—1088, type ♀—1089, paratypes 2 ♂ 1 ♀—1090–1092 (on one card), "Warburton, Vic., 7 Feb. 1962, C. Oke"; type ♂ and ♀ marked "T". Paratypes 3 ♂ 2 ♀—1093–1097 (on one card), data as for type. Paratypes 3 ♂ 2 ♀—1098–1102 (on one card), "Frankston, Vic., 23 Jan. 1926, C. Oke".

impressicollis Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 185, figs. 3a, h.
Hab.—Vic.: Warburton, Ballarat, Emerald.

Type ♂—725, "Warburton, Vic., C. Oke". Paratype ♂—726, "Ballarat, Vic., May 1928, C. Oke". Paratypes 2 ♂ 2 ♀—737–740, "Emerald, Vic., C. Oke".

inflatipes Oke (type species)

Warburtonia Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 105, figs. 21–27, 46.
Hab.—Vic.: Warburton.

Type (sex?)—1222, "Warburton, Vic., C. Oke".

intermixta Oke

Tomyris Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 170, fig. 23.
Hab.—Vic.: Anakies.

Type ♂—1280, "Anakies, Vic., 26 Dec. 1927, C. Oke". Described from unique ♂, the specimen bears id. label "*Tomyris comata*", but it appears that the author changed the specific name in the final draft. Specimen badly damaged by insect pests.

jucunda Oke

Monolepta Family Chrysomelidae.
1928, Proc. Linn. Soc. N.S.W., 53: 29.
Hab.—Vic.: Ferntree Gully, Emerald, Warburton.

Type ♂—841, type ♀—842 (on one card), "Emerald, Vic., 25 Oct. 1925, C. Oke". Paratype (sex?)—1291, "Ferntree Gully, Vic., May 1926, C. Oke".

kingi Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 9.
Hab.—Vic.: Eltham.

Type (sex?)—1128; without locality label on specimen.

lata Oke

Cryptomorpha Family Cucujidae.
1925, Vict. Nat., 42: 15.
Hab.—Vic.: Bendigo, Gypsum, Inglewood, Kiata, Maldon.

Type (sex?)—1292, "Bendigo, Vic., 2 Oct. 1921, C. Oke". Paratype (sex?)—607, "Gypsum, Vic., Nov. 1924, C. Oke". Paratype (sex?)—1559, "Kiata, Vic., 28 Dec. 1918, F. E. Wilson".

laterbricola Oke

Macrodicax Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 121, fig. 49.
Hab.—N.S.W.: Dorrigo.

Type ♂—1227, "Dorrigo, N.S.W., C. Oke".

leai Oke

Articerus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 23.
Hab.—Vic.: Lake Hattah.

Type ♂—936, type ♀—937, paratypes 2 ♂ 1 ♀—935, 938, 939 (on one card), "Lake Hattah, Vic., Nov. 1924, C. Oke". Type ♂ and ♀ marked "T".

leai Oke

Chlamydopsis Family Histeridae.
1923, Vic. Nat. 40: 155.
Hab.—Vic.: Ferntree Gully, Belgrave.

Type (sex?)—895, "Belgrave, Vic., 13 Dec. 1920, C. Oke". Paratype (sex?)—896, "Belgrave, Vic., 2 July 1921, C. Oke".

leai Oke

Mandalotus Family Curculionidae.
1931, Proc. roy Soc. Vict., 43: 184, figs. 3f, g, 4a.
Hab.—Vic.: Evelyn.

Type ♂—755, "Evelyn, Vic., C. Oke". Type ♀—756, same locality. Paratype ♂—757, same locality.

leai Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 10.

This name proposed by Oke replaces *R. villosa* Lea, 1912, not Raffray, 1904.

linearis Oke

Microtachyporus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 129.
Hab.—Vic.: Ringwood, Ferntree Gully.

Type—(not located).

lucaris Oke

Mandalotus Family Curculionidae.
1934, Proc. roy. Soc. Vict., 46: 258.
Hab.—N.S.W.: Dorrigo.

Type ♂—1348, type ♀—1350, paratype ♂—1349 (on one card) without locality label. Type ♂ marked "T", type ♀ marked "A". Another ♀ on this card has been destroyed by insect pests.

lucifugus Oke (type species)

Eupinolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 11.
Hab.—Vic.: Ferntree Gully, Warburton.

Type (sex?)—1130, paratypes (sex?)—1131–1132 (on one card), "Ferntree Gully, Vic., C. Oke"; type marked "T".

luciphilus Oke

Mandalotus Family Curculionidae.
1934, Proc. roy. Soc. Vict., 46: 257, figs. 12–14.
Hab.—N.S.W.: Paterson.

Type ♂—758, "Paterson, N.S.W., C. Oke".

macquariensis Oke

Bryaxis Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 155, fig. 10.
Hab.—N.S.W.: Port Macquarie.

Type ♂—1103, "Port Macquarie, N.S.W., C. Oke".

macrops Lea

Mandalotus Family Curculionidae.
1926, Rec. S.Aust. Mus., 3: 183, fig. 80u (Lea).
1931, Proc. roy. Soc. Vict., 43: 182.
Hab.: Vic.: Beechworth (Oke).

Allotype ♀ (Plesioallotype)—(not located).

major Oke

Phrynixus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 45: 194, fig. 5b.
Hab.—Vic.: Belgrave, Gembrook.

Type (sex?)—863, "Belgrave, Vic., 3 Apr. 1927, C. Oke". Paratype (sex?)—864, "Belgrave, Vic., 17 Dec. 1921, C. Oke". Paratype (sex?)—865, "Gembrook, Vic., C. Oke".

marginalis Oke

Quedius Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 124.
Hab.—Vic.: Belgrave.

Type—(not located).

melanocephala Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 8.
Hab.—Vic.: Daylesford.

Type (sex?)—1123, paratype (sex?)—1124, 1125, "Daylesford, Vic., C. Oke". Paratypes—1126, ♀—1127, locality as for type.

melculus Oke

Edaphellus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 110, figs. 28, 58.
Hab.—Vic.: Belgrave, Gembrook, Warburton, Preston, Macedon.

Type (sex?)—1342, "Belgrave, Vic., 2 July 1921, C. Oke". Paratype (sex?)—1343, "Belgrave, Vic., 1 July 1921, C. Oke".

A specimen from Evelyn was labeled as type, and a specimen from Lilydale as paratype of *Edaphellus melculus,* but in the publication both these localities are entered under *E. melculus* var. *camponoti,* and therefore could not be regarded as types of the actual species, but of the variety. The only specimens corresponding to the localities of *melculus* were the two from Belgrave, and they are now considered as the type and paratype of the species.

metallica Oke

Arsipoda Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 171.
Hab.—Vic.: Ringwood, Ferntree Gully, Killara, Warburton.

Type ♂—2647, type ♀—2648 (on one card), "Killara, Vic., C. Oke". 2 paratypes (sex?)—2649, 2650 (on one card) "Ringwood, Vic., 19 Oct. 1919, C. Oke". 2 paratypes ♂—2651, ♀ 2652 (on one card), "Warburton, Vic., C. Oke". Paratype (sex?)—2653, "Warburton, Vic., 30 Dec. 1922, C. Oke". Paratype (sex?)—2654, "Ferntree Gully, Vic., C. Oke".

militaris Oke

Bledius Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 108, fig. 68.
Hab.—Vic.: Ringwood, Belgrave.

Type (sex?)—1320, "Ringwood, Vic., 1 Dec. 1923, C. Oke". Paratypes (sex?)—1311, 1312, "Belgrave, Vic., C. Oke".

minor Oke

Brachycaulus Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 166, figs., 19, 20.
Hab.—Vic.: Inglewood, Sea Lake.

Type ♂—1289, type ♀—1290 (on one card), "Inglewood, Vic., 1 Jan. 1920, C. Oke".

minor (var.) Oke

Chlamydopsis pygidialis Blkb. var. Family Histeridae.
1923, Vic. Nat., 40: 153.
Hab.—Vic.: Belgrave, Ferntree Gully, Beaconsfield.

Type (sex?)—891, " Ferntree Gully, Vic., 16 May 1920, C. Oke ".

minusculus Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 189.
Hab.—Vic.: Carrum.

Type ♂—760, type ♀—764, paratypes ♂ ♀—761–763, 765–767 (all on one card), " Carrum, Vic., C. Oke ". Type ♂ marked " T ", type ♀ marked " A ".

minuta Oke

Diplocotes Family Ptinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 26.
Hab.—Vic.: Bendigo.

Type (sex?)—595, " Bendigo, Vic., 13 Sept. 1920, C. Oke ".

mirabilis Oke (type species)

Aculagnathus Family Aculagnathidae.
1932, Proc. roy. Soc. Vict., 44: 23, pl. 2, figs. 1–6.
Hab.—Vic.: Belgrave.

Type (sex?)—826, paratype (sex?)—827 (on one card), " Belgrave, Vic., C. Oke "; type marked " T ". Paratypes (sex?)—828–830 same locality as type.

monstrabilis Oke

Rybaxis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 7.
Hab.—Vic.: Ferntree Gully.

Type ♂—2655, type ♀—2656, paratype ♂—2657 (on one card), " Belgrave, Vic., 25 Oct. 1925, C. Oke ". Type ♂ marked " T ", type ♀ marked " A ". (Discrepancy in locality is explained that Oke never did publish detailed collecting data for type specimens, and as both localities are close together, he apparently was not critical on their separation.) Paratype ♂—2658 apparently specimen which should be referred to that collected in July.

montana Oke

Arsipoda Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 170, fig. 24.
Hab.—Vic.: Beechworth, Mt. Buffalo. N.S.W.: Mt. Kosciusko.

Type ♂—1285, type ♀—1286, " Beechworth, Vic., C. Oke ".

montanus Oke

Allochromicis Family Anthribidae.
1934, Proc. roy. Soc. Vict., 46: 252, fig. 8.
Hab.—Vic.: Warburton, Mt. Donna Buang.

Type (sex?)—612, " Warburton, Vic., 4080 feet, 15 Feb. 1931, C. Oke ".

montigena Oke

Stigmodera Family Buprestidae.
1928, Proc. Linn. Soc. N.S.W., 53: 25.
Hab.—Vic.: Warburton Ranges.

Type (sex?)—1197, " Warburton, Vic., C. Oke ".

myrmeciae Oke

Calodera Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 130.
Hab.—Vic.: Warburton.

Type (sex?)—1215, paratype (sex?)—1216 (on one card), " Warburton, Vic., 13 Mar. 1921, C. Oke "; type marked " T ". Paratype (sex?)—1217; same data as for type.

myrmecophila Oke

Malleecola Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 15.
1926, Vict. Nat. 42: 281 (short characteristics and MSS. name).
Hab.—Vic.: Gypsum, Lake Hattah.

Type ♂—1151, type ♀—1153, paratype ♂—1152, ♀—1154 (on one card), " Lake Hattah, Vic., Nov. 1924, C. Oke ".

nigella Oke

Eupines Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 13.
Hab.—Vic.: Ferntree Gully, Gembrook.

Type ♂—1141, type ♀—1142, paratype ♂—1140, ♀—1143 (on one card), " Gembrook, Vic., 6 June 1927, C. Oke ". Type ♂ and ♀ marked " T ". Paratypes 2 ♂ 1 ♀—1144–1146 (on one card), same data as for type.

nigra (var.) Oke

Isacantha papulosa Pascoe var. Fam. Belidae.
1934, Proc. roy. Soc. Vict., 46: 262.
Hab.—Vict.: Gypsum.

Type (sex?)—1306, " Gypsum, Vic., Nov. 1926, C. Oke ".

nigricans Oke

Paratoxicum Family Tenebrionidae.
1932, Proc. Linn. Soc. N.S.W., 57: 159.
Hab.—Vic.: Bairnsdale, Belgrave, Traralgon.

Type (sex?)—1208, " Belgrave, Vic., 5 Aug. 1922, C. Oke ".

nitidum Oke

Scimbalium Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 122, fig. 50.
Hab.—Vic.: Lake Hattah.

Type ♀—1228, "Lake Hattah, Vic., Nov. 1924, C. Oke". The specimen has been completely destroyed by insect pests, and only one leg remained on card.

nothus Oke

Leptops Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 180, fig. 2a.
Hab.—Vic.: Belgrave, Mitchell Gorge.

Type (sex?)—884, "Mitchell Gorge, Vic., Jan. 1929, C. Oke". Paratype (sex?)—885, "Belgrave, Vic., 16 Apr. 1922, C. Oke".

obliquus Oke

Mandalotus Family Curculionidae.
1934, Proc. roy. Soc. Vict., 46: 256, figs. 21–22.
Hab.—N.S.W.: Dorrigo.

Type ♂—773, type ♀—775, paratype ♂—774 (on one card), "Dorrigo, N.S.W., C. Oke".

obscurus Oke

Eupinolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53:13.
Hab.—Vic.: Evelyn.

Type (sex?)—1139, "Evelyn, Vic., C. Oke".

octagonalis Oke

Mandalotus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 188, fig. 35.
Hab.—Vic.: Warburton.

Type ♂—759, "Warburton, Vic., C. Oke".

orientalis Oke

Plectostenus Family Pselaphidae.
1928, Proc. Linn. Soc., N.S.W., 53: 6.
Hab.—Vic.: Bendigo; N.S.W. (no locality).

Type ♂—1121, "Bendigo, Vic., 12 Sept. 1920, C. Oke".

ovensensis Oke (type species)

Neosphaerius Family Sphaeriidae.
1954, Proc. roy. Soc. Vict., 65: 59, figs. 1–11.
Hab.—Vic.: Harrietville, Wondilligong.

Type (sex?)—831, paratypes (sex?)—832–834 (on one card), "Harrietville, Vic., C. Oke". Type marked "T".

pallipes Oke

Hyperomma Family Staphylinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 3.
Hab.—Vic.: Grampians.

Type ♂—1240, "Grampians, Vic., Nov. 1924, C. Oke".

panacis Oke

Blepiarda Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 199, figs. 6a, f.
Hab.—Vic.: Ferntree Gully.

Type ♂—853, type ♀—854 (on one card), "Ferntree Gully, Vic., C. Oke". Paratypes ♂—855, ♀—856 (on one card), "Ferntree Gully, Vic., Oct. 1928, C. Oke ex *Tieghempana sambucifallus*".

parasitus Oke

Eupinolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 12.
Hab.—Vic.: Belgrave, Emerald, Bayswater.

Type ♂—1133, type ♀—1135, paratypes ♂—1134, ♀—1136 (on one card), "Belgrave, Vic., 1 July 1921, C. Oke". Type ♂ and ♀ marked "T".

parvus Oke

Rhadinosomus Family Curculionidae.
1934. Proc. roy. Soc. Vict., 46: 254, figs. 9, 10.
Hab.—N.S.W.: Dorrigo.

Type (sex?)—886, paratype (sex?)—887 (on one card), "Dorrigo, N.S.W., Jan. 1931, C. Oke". Type marked "T".

passerculus Oke (type species)

Austroesthethus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 112, figs. 29–31, 54.
Hab.—Vic.: Ferntree Gully, Belgrave, Warburton, Mt. Donna Buang; N.S.W.: Mt. Kosciusco.

Type ♂—2885, "Warburton, Vic., 15 Feb. 1931, C. Oke, 4,080 ft." Allotype ♀—2886, "Ferntree Gully, Vic., 16 Apr. 1927, C. Oke". Paratype ♀—1328, "Belgrave, Vic., C. Oke", another locality label on this latter specimen reads "Mt. Kosciusko, N.S.W., C. Oke".

pentagonoderes Lea

Mandalotus Family Curculionidae.
1929, Proc. Linn. Soc. N.S.W., 54: 528 (Lea).
1931, Proc. roy. Soc. Vict., 43: 128 (Oke).
Hab.—Vic.: Belgrave, Emerald, Warburton.

Allotype ♀ (Plesioallotype)—776, "Warburton, Vic., 4080 feet, 15 Feb. 1931, C. Oke". 2 ♂ and 2 ♀ on one card, allotype ♀ marked "A".

pescotti Oke

Xanthophoea Family Carabidae.
1951, Mem. Nat. Mus. Vict., 17: 19.
Hab.—W.A.: Pimelea.

Holotype ♂—1202, allotype ♀—1203 (on one card), "Pimelea, W.A., 7 Sept. 1947, R. T. M. Pescott". Paratype ♂—1204, same data as for holotype.

pictipes Oke

Oedichirus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 115.
Hab.—N.S.W.: Mt. Wilson.

Type—(not located).

pictum Oke

Conosoma Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 126.
Hab.—Vic.: Warburton.

Type (sex?)—1307, "Warburton, Vic., Jan. 1929, C. Oke".

pictus Oke (type species)

Dixoncis Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 196, figs. 6b, c.
Hab.—Vic.: Killara, Ringwood–Bayswater district. Tas.: Cradle Mountains.

Type (sex?)—888, "Killara, Vic., 21 Nov. 1910, C. Oke". Paratype (sex?)—889, "Killara, Vic., C. Oke".

pilosus Oke

Cotulades Family Tenebrionidae.
1932, Proc. Linn. Soc. N.S.W., 57: 158.
Hab.—Vic.: Beechworth.

Type (sex?)—1293, "Beechworth, Vic., 20 Apr. 1930, C. Oke". Paratypes (sex?)—1294–1295 (on one card); 1296–1297 (on one card), all same data as for type.

polypunctum Oke

Hyperomma Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 121, fig. 74.
Hab.—N.S.W.: Dorrigo.

Type ♀—1231, "Dorrigo, N.S.W., C. Oke".

postcoxalis Oke

Palimbolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 21.
Hab.—Vic.: Warburton.

Type ♂—1186, type ♀—1187, paratypes ♂—1185, ♀—1188 (on one card), "Warburton, Vic., 7 Feb. 1926, C. Oke". Type ♂ and ♀ marked "T".

punctatus Oke

Austroesthethus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 144.
Hab.—Vic.: Grampians.

Type ♂—1560, " Grampians, Vic., C. Oke ".

puncticollis Oke

Chlamydopsis Family Histeridae.
1923, Vict. Nat. 40: 156.
Hab.—Vic.: Ferntree Gully.

Type (sex?)—897, " Ferntree Gully, Vic., 26 May 1920, C. Oke ". Paratype (sex?)—898, " Ferntree Gully, Vic., 20 June 1920, C. Oke ".

quadridentatus Lea

Tyromorphus Family Pselaphidae.
1911, Proc. Linn. Soc. N.S.W., 35: 764 (Lea).
1928, Proc. Linn. Soc. N.S.W., 53: 19 (Oke) (*quadridentatis*—misspelling by Oke).
Hab.—Vic.: Evelyn, Emerald, Warburton (Oke); Tas.: Lea.

Allotype ♂ (Plesioallotype)—1174 (on one card with another specimen), " Emerald, Vic., C. Oke ". Allotype marked " T ".

reticulatus Oke

Medon Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 117, figs. 51, 52, 77.
Hab.—Vic.: Sunshine, Bendigo.

Type ♀—1229, " Sunshine, Vic., 5 Oct. 1924, C. Oke ". Paratype (sex?)—1230, " Bendigo, Vic., C. Oke ".

robustum Oke

Itheum Family Cerambycidae.
1932, Proc. Linn. Soc. N.S.W., 57: 164, fig. 16.
Hab.—N.S.W.: Dorrigo.

Type (sex?)—1263, paratype (sex?)—1264 (on one card), " Dorrigo, N.S.W., C. Oke ".

rufipes Oke

Warburtonia Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 107.
Hab.—Vic.: Warburton.

Type (sex?)—1220, " Warburton, Vic., C. Oke ". Paratype (sex?)—1221, " Warburton, Vic., C. Oke ".

rufomaculatus (var.) Oke

Chlamydopsis ectatommae Lea var. Family Histeridae.
1923, Vict. Nat. 40: 153.
Hab.—Vic.: Melton, Bacchus Marsh.

Type (sex?)—892, " Bacchus Marsh, Vic., 30 Oct. 1920, C. Oke ".

rugicornis Oke

Sagola Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 149, fig. 3.
Hab.—Vic.: Warburton, Mt. Donna Buang.

Type ♂—1081, "Warburton, Vic., 4080 feet, 15 Feb. 1931, C. Oke".

rugosus Oke

Palimbolus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 21.
Hab.—Vic.: Carrum, Frankston.

Type ♂—1182, type ♀—1183, paratypes ♂—1181, ♀—1184 (on one card), "Carrum, Vic., July 1927, C. Oke". Type ♂ and ♀ marked "T". Paratype ♀—2646, "Carrum, Vic., 18 Oct. 1925, C. Oke".

satealles Oke (type species)

Amblyoponiphilus Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 134, figs. 62, 63, 89–91.
Hab.—Vic.: Ferntree Gully, Belgrave, Gembrook, Evelyn, Warburton, Macedon.

Type (sex?)—1334, paratype (sex?)—1335 (on one card), "Ferntree Gully, Vic., 23 July 1922, C. Oke". Type marked "T".

sculptus Oke

Chlamydopsis Family Histeridae.
1923, Vict. Nat., 40: 158.
Hab.—Vic.: Ballarat, Sea Lake, Bendigo, Macedon, Daylesford; S.A.: Mount Lofty.

Type (sex?)—902, "Macedon, Vic., 23 Apr. 1921, C. Oke". Paratype (sex?)—903, "Bendigo, Vic., 1 Oct. 1921, C. Oke". Paratype (sex?)—1278, "Sea Lake, Vic., 15 Sept. 1912, J. C. Goudie".

setifera Oke († — Fossil)

Eupines Family Pselaphidae.
1957, Proc. roy. Soc. Vict., 69: 29, figs. 1–4.
Loc.:—Allendale, Vic. (ex. Cainozoic resin).

Type:—University of Melbourne, Geology Department, No. 2493.

setipennis Oke

Chlamydopsis Family Histeridae.
1923, Vict. Nat., 40: 154.
Hab.—Vic.: Ferntree Gully, Belgrave, Sassafras, Evelyn.

Type (sex?)—893, "Evelyn, Vic., 5 June 1920, C. Oke". Paratype (sex?)—894, "Belgrave, Vic., 3 July 1921, C. Oke".

setosa Oke

Diethusa Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 198.
Hab.—Vic.: Bendigo.

Type ♂—1209, "Bendigo, Vic., Sept. 1929, C. Oke".

similis Oke

Ecrizothis Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 177.
Hab.—Vic.: Lorne.

Type ♂—872, type ♀—873 (on one card), "Lorne, Vic., C. Oke".

similis Oke

Polyplocotes Family Ptinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 27.
Hab.—Vic.: Inglewood.

Type (sex?)—591, "Inglewood, Vic., 23 Dec. 1923, C. Oke".

socialis Oke

Eupinolus Family Pselaphidae
1928, Proc. Linn. Soc. N.S.W., 53: 12.
Hab.—Vic.: Ferntree Gully, Belgrave.

Type ♂—1137, paratype ♂—1138, (on one card), "Belgrave, Vic., 14 Sept. 1924, C. Oke".

speciosus King

Tyromorphus Family Pselaphidae.
1865, Trans. Ent. Soc. N.S.W., 1: 168 (King).
1928, Proc. Linn. Soc. N.S.W., 53: 20 (Oke).
Hab.—Vic.: Ferntree Gully, Upwey, Belgrave, Emerald.

Allotype ♀ (Plesioallotype)—1175, "Emerald, Vic., C. Oke".

squamosus Oke

Narcodes Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 18.
Hab.—Vic.: Warburton.

Type ♂—1164, type ♀—1166, paratypes ♂—1165, ♀—1167 (on one card), "Warburton, Vic., 27 Dec. 1925, C. Oke". Type ♂ and ♀ marked "T". Paratypes 2 ♂ 2 ♀—1168–1171 (on one card) same data as for type.

squamulosus Oke

Pselaphus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 18.
Hab.—Vic.: Ferntree Gully, Emerald.

Type (sex?)—1162, paratypes (sex?)—1161, 1163 (on one card), "Ferntree Gully, Vic., C. Oke". Type marked "T".

sternalis Oke

Rybaxis Family Pselaphidae.
1925, Vict. Nat. 42: 9.
Hab.—Vic.: Beaconsfield, Evelyn.

Type ♂—933, type ♀—934 (on one card), "Evelyn, Vic., June 1921, C. Oke".

strigicollis Oke

Chlamydopsis Family Histeridae.
1923, Vict. Nat., 40: 157.
Hab.—Vic.: Hurstbridge, Belgrave, Ferntree Gully, Beaconsfield, Mooroolbark.

Type ♂—899, "Belgrave, Vic., 17 Oct. 1921, C. Oke". Type ♀—900, "Belgrave, Vic., 17 Oct. 1921, C. Oke". Paratype ♂—901, "Hurstbridge Vic., 10 Oct. 1920, C. Oke".

subopacum Oke

Dabrasoma Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 131, fig. 93.
Hab.—Vic.: Melbourne, Eltham, Killara.

Type (sex?)—1333, "Eltham, Vict., Sept. 1920, C. Oke".

sulcicollis Oke

Dabra Family Staphylinidae.
1928, Proc. Linn. Soc. N.S.W., 53: 1.
Hab.: Vic.: Gypsum.

Type (sex?)—1212, "Gypsum, Vic., Nov. 1926, C. Oke". Paratype (sex?)—1213, "Gypsum, Vic., C. Oke". Paratype (sex?)—1214, "Gypsum, Vic., Nov. 1926, C. Oke".

sulciventris Oke

Pselaphus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 17.
Hab.—Vic.: Gypsum.

Type ♂—1160, "Gypsum, Vic., Nov. 1924, C. Oke".

sylvicola Oke

Phrynixus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 193.
Hab.—Vic.: Belgrave, Gembrook.

Type (sex?)—860, "Gembrook, Vic., 6 June 1927, C. Oke". Paratypes (sex?)—861, 862, "Belgrave, Vic., C. Oke".

tarsalis Oke

Enneboeus Family Tenebrionidae.
1932, Proc. Linn. Soc. N.S.W., 57: 159, figs. 12, 13.
Hab.—Vic.: Emerald.

Type ♂—1205, "Emerald, Vic., C. Oke". Type ♀—1206, "Emerald, Vic., C. Oke". (Another specimen on the same card, but without head.)

terminalis Oke

Ecrizothis Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 179, fig. 1b.
Hab.—Vic.: Grampians, Portland.

Type (sex?)—874, "Grampians, Vic., C. Oke". Paratypes (sex?)—875, 876 (on one card), same locality as type.

termitophilus Oke

Tyromorphus Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 19.
Hab.—Vic.: Violet Town.

Type ♂—1172, type ♀—1173 (on one card), "Violet Town, Vic., July 1924, C. Oke".

terricola Oke

Microdonacia Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 166, fig. 18.
Hab.—Vic.: Emerald.

Type (sex?)—1287, paratype (sex?)—1288 (on one card), "Emerald, Vic., Sept. 1920, C. Oke".

testaceipes Lea

Scopaeus Family Staphylinidae.
1923, Trans. roy. Soc. S.A., 47: 27 (Lea).
1933, Proc. roy. Soc. Vict., 45: 116 (Oke).
Hab.—Vic.: Warburton, Ferntree Gully.

Allotype ♂ (Plesioallotype)—1239, "Warburton, Vic., 1 Apr. 1929, C. Oke". Allotype marked "A" on one card with another ♂ specimen.

themedicola Oke

Monolepta Family Chrysomelidae.
1928, Proc. Linn. Soc. N.S.W., 53: 29.
Hab.—Vic.: Evelyn, Ferntree Gully.

Type ♀—843, "Evelyn, Vic., 8 June 1926, C. Oke".

tibialis Wilson

Tyromorphus Family Pselaphidae.
1926, Proc. roy. Soc. Vict., 39: 37 (Wilson).
1928, Proc. Linn. Soc. N.S.W., 53: 20 (Oke).
Hab.—Vic.: Warburton, Evelyn, Pakenham, Ferntree Gully, Drysdale.

Allotype ♀ (Plesioallotype)—1176 marked "A" on one card together with 2 ♂ and 1 ♀, "Ferntree Gully, Vic., 23 July 1922, C. Oke".

tricolor Oke

Sagola Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 5.
Hab.—Vic.: Warburton.

Type (sex?)—1116, "Warburton, Vic., C. Oke".

trifoveata Oke

Batraxys Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 6.
Hab.—Vic.: Eltham.

Type (♂?)—1122, "Eltham, Vic., 18 Oct. 1924, C. Oke".

trochanteris Oke

Rybaxis Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 154.
Hab.—N.S.W.: Dorrigo.

Type ♂—1086, type ♀—1087, (on one card), "Dorrigo, N.S.W., C. Oke".

tuberculata Oke (type species)

Nyella Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 200, figs. 6g, h, i.
1934, Proc. roy. Soc. Vict., 46: 262, (additional description).
Hab.—Vic.: Mitchell Gorge.

Type ♂—851, type ♀—852 (on one card), "Mitchell Gorge, Vic., Jan. 1929, C. Oke".

tuberculatus Oke

Macroplectus Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 152.
Hab.—Vic.: Belgrave, Evelyn.

Type ♂—2671, type ♀—2672 (on one card); there is no locality label attached to the specimens; a third specimen—♀ on the same card has been destroyed by insect pests, with only part of abdomen remaining on card.

umbratilis Oke (type species)

Cisolea Family Curculionidae.
1934, Proc. roy. Soc. Vict., 46: 260, figs. 21–28.
Hab.—N.S.W.: Dorrigo.

Type ♂—2201, "Dorrigo, N.S.W., C. Oke". Paratypes 2 ♂—2202–2203, 2 ♀—2204–2205, "Dorrigo, N.S.W., C. Oke" (on one card).

umbratilis Oke

Daulotypus Family Endomychidae.
1932, Proc. Linn. Soc. N.S.W., 57: 161, fig. 15.
Hab.—Vic.: Ferntree Gully.

Type (sex?)—1346, "Belgrave, Vic., 16 Apr. 1922, C. Oke".
Irrespective to the fact that the only published locality is Ferntree Gully, specimen selected as type by Oke was labeled "Belgrave", no other specimen of this species from the former locality has been located in the collection.

uniclavata Oke

Eupinopsis Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 10.
Hab.—Vic.: Belgrave.

Type ♂—1129, "Belgrave, Vic., 2 July 1921, C. Oke".

uvida Oke (type species)

Daylesfordia Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 195, figs. 3i, 6d.
Hab.—Vic.: Daylesford.

Type ♂—857, type ♀—858, (on one card), "Daylesford, Vic., C. Oke".

vagans Oke

Quedius Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 125.
Hab.—Vic.: Belgrave. N.S.W.: Dorrigo.

Type—(not located).

vagus Oke

Rybaxis Family Pselaphidae.
1932, Proc. Linn. Soc. N.S.W., 57: 153.
Hab.—Vic.: Mitchell Gorge, Warburton, Ferntree Gully. N.S.W.: Dorrigo.

Type ♂—2663, type ♀—2664 (on one card), "Mitchell Gorge, Vic., Jan. 1929, C. Oke". 4 paratypes 2 ♂ 2 ♀—2665–2668, same data as for types. Paratype—2669, "Ferntree Gully, Vic., Feb. 1922, C. Oke".

varia Oke

Mandalotina Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 191.
Hab.—Vic.: Emerald.

Type (sex?)—1553, "Emerald, Vic., C. Oke".

variabilis Oke

Earinus Family Cerambycidae.
1932, Proc. Linn. Soc. N.S.W., 57: 163.
Hab.—Vic.: Whittlesea. S.A.: no exact locality (S.A. Museum specimen).

Type (sex?)—1242, "Whittlesea, Vic., 9 Nov. 1908, C. Oke".

ventralis Oke

Sagola Family Pselaphidae.
1928, Proc. Linn. Soc. N.S.W., 53: 4.
Hab.—Vic.: Carrum.

Type ♂—1109, type ♀—1110, paratypes ♂ ♀—1111–1112 (on one card), "Carrum, Vic., Aug. 1927, C. Oke". Type ♂ and ♀ marked "T". Paratypes ♂—1113, ♀—1114 (on one card), "Carrum, Vic., Oct. 1926, C. Oke".

venusta Oke

Diethusa Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 199.
Hab.—Vic.: Gypsum.

Type (sex?)—1210, paratype (sex?)—1211 (on one card), "Gypsum, Vic., Nov. 1926, C. Oke".

victoriae Oke, *Bledius* (Figures only), see *Bledius australis* Oke.

victoriae Oke

Osorius Family Staphylinidae.
1933, Proc. roy. Soc. Vict., 45: 102, figs. 6–12, 42.
Hab.—Vic.: Carrum, Ringwood, Lorne.

Type (sex?)—1330, paratype (sex?)—1331 (on one card), "Lorne, Vic., C. Oke". Paratype (sex?)—1332, "Carrum, Vic., 8 Aug. 1926, C. Oke".

victoriae Oke

Phrynixus Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 192, fig. 5a.
Hab.—Vic.: Belgrave, Warburton.

Type (sex?)—859, "Emerald, Vic., Aug. 1925, C. Oke".

victoriae Oke

Sagola Family Pselaphidae.
1925, Vict. Nat., 42: 7.
Hab.—Vic.: Belgrave, Macedon, Daylesford.

Type ♀—1060, "Macedon, Vic., C. Oke". Paratype (sex?)—1061, "Belgrave, Vic., Feb. 1924, C. Oke". Paratype (sex?)—1062, "Daylesford, Vic., Nov., C. Oke".

villosum Oke

Itheum Family Cerambycidae.
1932, Proc. Linn. Soc., N.S.W., 57: 164.
Hab.—Vic.: Natya, Hattah.

Type (sex?)—1265, paratype—1266, "Hattah, Vic., C. Oke". Paratype (sex?)—1267, "Natya, Vic., 24 Sept. 1922, C. Oke". Paratypes (sex?)—1268–1269. "Lake Hattah, Vic., J. E. Dixon".

viridis Oke

Polyphrades Family Curculionidae.
1931, Proc. roy. Soc. Vict., 43: 179.
Hab.—Vic.: Hattah.

Type (sex?)—879, paratype (sex?)—880, "Hattah, Vic., Nov. 1924, C. Oke". Paratypes 1 ♂ 2 ♀—882–883 (on one card), "Hattah, Vic., C. Oke".

vitinea Oke (type species)

Austrolema Family Chrysomelidae.
1932, Proc. Linn. Soc. N.S.W., 57: 165, fig. 17.
Hab.—Vic.:—Mitchell Gorge.

Type (sex?)—844, paratypes—845, 846 (on one card), "Mitchell Gorge, Vic., Jan. 1929, C. Oke". Paratypes—847, 848 (on one card) and 849, 850 (on one card), "Mitchell Gorge, Vic., C. Oke". Paratype—1558, "Mitchell Gorge, Vic., Jan. 1929, C. Oke".

vulgaris Oke

Narcodes Family Pselaphidae.
1925, Vic. Nat., 42: 11.
Hab.—Vic.: Ringwood, Pakenham, Killara, Warburton, Ferntree Gully, Mitcham.

Type ♂—1069, type ♀—1070, paratypes ♂—1071, ♀—1072 (on one card), "Ringwood, Vic., Sept. 1921, C. Oke".

MARINE TRICLADIDA FROM MACQUARIE ISLAND.

F. R. Nurse (Mrs. F. R. Allison), Department of Zoology, University of Canterbury, New Zealand.

Introduction.

The Triclad material examined in this paper was sent to me by the Antarctic Division, Department of External Affairs, Melbourne, (A.N.A.R.E.). The material includes specimens from collections made in 1948, 1949 and 1950 from Macquarie Island.

Order: Tricladida.
Section: Maricola.
Family: *Procerodidae.*
Sub-Family: *Procerodinae.*

1. *Procerodes wandeli* Hallez (Figs. 1 and 2).

30/XI/48 R.K. Nat. Mus. No. G1225. Littoral rock pools. 5 specimens.

The specimens examined correspond to those described by Hallez from Wandes Island, Moureau Island, &c. The upper surface is pigmented with a darker pigment in a pattern laterally (Fig. 1) or it may be uniformly pigmented with a lighter patch at the anterior end. Hallez points out that the pigmentation varies in specimens collected from different places. There are no lugs. The reproductive system corresponds to the description given by Wilhelmi 1909, except that the penis is more finger shaped than cone shaped. There are three parts to the penis, a basal one distinguished by strong circular muscles, a central one with a secretory reservoir and an apical part with an ejaculatory duct. The ovovitelline ducts are ventral and join posteriorly to form a common duct which enters the top of the vagina, from which point the bursa canal runs forwards to enter the bursa copulatrix which lies dorsal to the tip of the penis (Fig. 2).

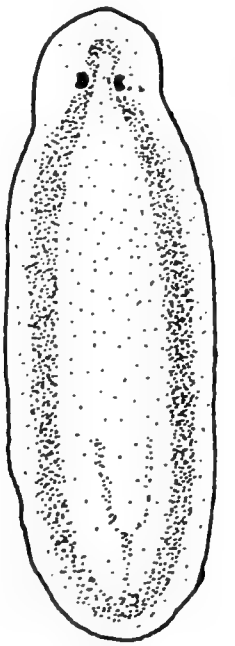


Fig. 1. *Procerodes wandeli.*

The key to the abbreviations used in the Text Figures is located at the end of the paper.

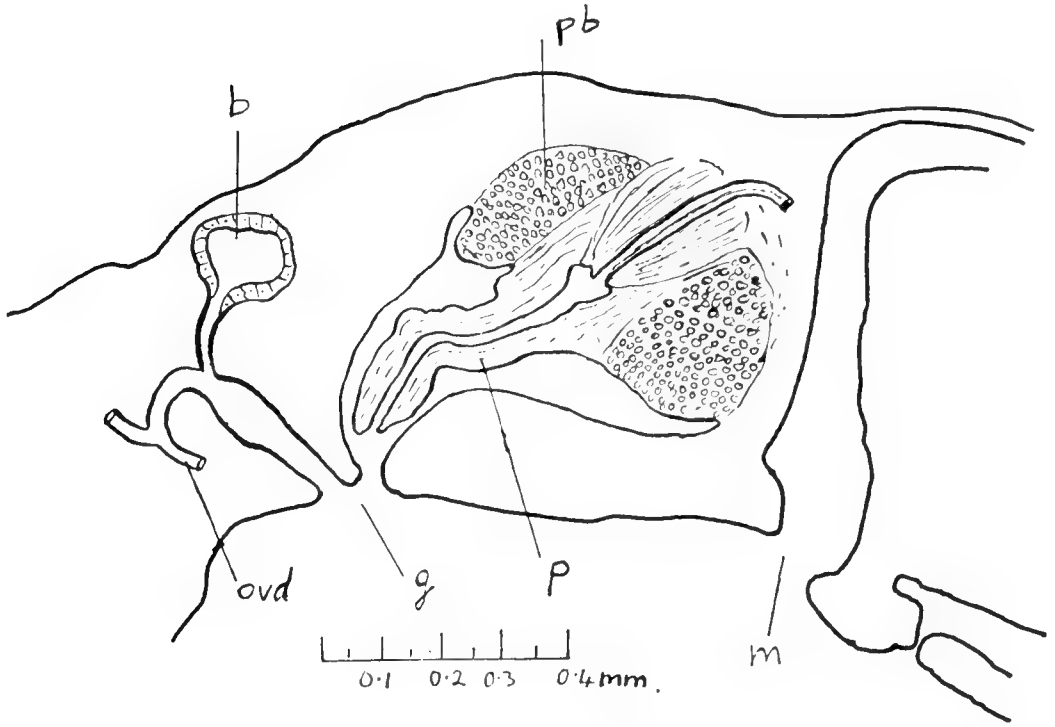


Fig. 2. *P. wandeli.* Longitudinal sagittal section through the genital region.

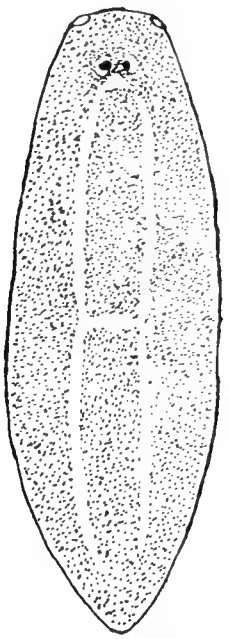


Fig. 3. *P. hallezi.*

2. *Procerodes hallezi* (Böhmig) (Figs. 3 and 4).

1. MI/49/T6. 12.2.50. N. M. Hayson. Nat. Mus. No. G.1226. From lithothamnion-encrusted pool on reef, Buckles Bay. 6 specimens.
2. MI/49/T1. 29.4.49. Nat. Mus. No. G1227. From weed washings in reef pool, Buckles Bay.

5–6 mm. long and 1·5–2 mm. wide. The upper side is dark grey with light patches between the eyes and above the pharynx and two parallel light lines running the length of the body. The genital apparatus corresponds to the description given by Marcus (1954). The testes are ventral, follicles numerous. They extend from just behind the ovary to level with the posterior end of the genital apparatus, that is, about the level of the bursa copulatrix. (More extensive than described by Westblad.) The genital apparatus is similar to the description given by Marcus. There is no vesicula seminalis. The vasa deferentia lie side by side in the muscular portion of the penis bulb.

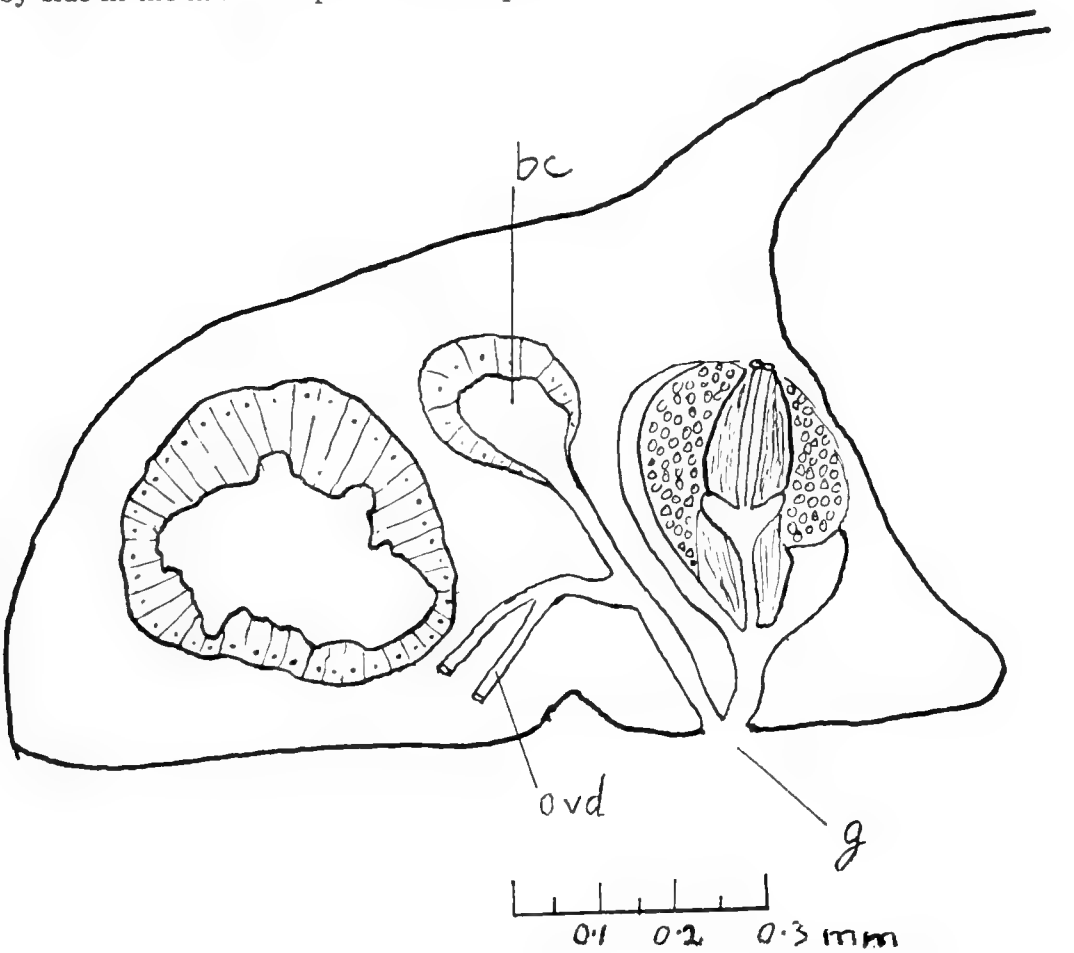


Fig. 4. *P. hallezi.* Longitudinal sagittal section through the genital region.

3. *Procerodes ohlini* (Bergendahl 1899).

MI/49/T3. 26.1.50. N. M. Hayson. Nat. Mus. No. G1228. Under rocks, shallow water. Aerial cove.

The dorsal side is dark grey with two light streaks down the length of the body. Ventral side pale grey. Size 8 mm. x 2·5 mm. The anatomical structure agrees with the description of this species given by Wilhelmi 1909.

4. *Procerodes variabilis* (Böhmig 1902, 1906).

MI/49/T2. 26.1.50. N. M. Hayson. Nat. Mus. No. G1229. Under rocks, shallow water. Aerial cove; 2 specimens.

2.1.49. Nat. Mus. No. G1230. Rock pools. R. Kenny. 1 specimen.

Pale brown in colour with very fine mottling, slightly paler underside. Eyes very small. Length 5 mm. Width 1·5 mm. The size and shape of the specimens corresponds to that of *P. variabilis* Böhmig (1902, 1906). The copulatory apparatus is similar to that described in Wilhelmi 1908 and also by Westblad 1951. The external appearance seems to be different, this specimen being pale brown whereas the one described by Böhmig was white.

Family: Bdellouridae.

1. *Palombiella macquari* n. sp. (Figs. 5, 6, 7, 8, 9, 10, and 11.)

MI/49/T3. 26.1.50. N. M. Hayson. Nat. Mus. No. G.1220. Holotype. Under rocks, shallow water. Aerial cove. There was one specimen only, well preserved, 3·5 mm. long and 1·5 mm. wide.

27/V/48 R.K. Nat. Mus. No. G1222. Fixed in formalin. Rock pools. The specimens were faded and very curled. Tissues not very well preserved.

2/1/49 R.K. Nat. Mus. No. G1223. Fixed in formalin. Rock pools. 2 specimens, not very well preserved. 4 mm. x 1 mm.

28/12/48 R.K. Nat. Mus. No. G1221. Paratypes. Fixed in formalin. Rock pools. Garden cove. Eighteen specimens, not very well preserved but better than the two preceding collections.

The description of the new species is based mainly on collections MI/49/T3 and 28/12/48 which were better preserved than the others. The size ranged from 3·5 mm. x 1·5 mm. to 7 mm. x 3 mm. The upper surface of the worm is uniformly greyish with white patches above the pharynx and above the genital region. Also white patches around the pigmented eyes. Dark grey to almost black region in front of the eyes. (See Fig. 5.)

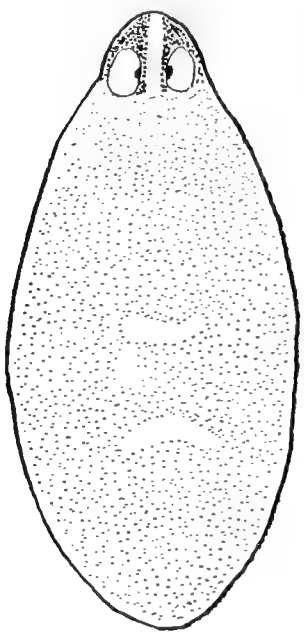


Fig. 5. *Palombiella macquari* n.sp.

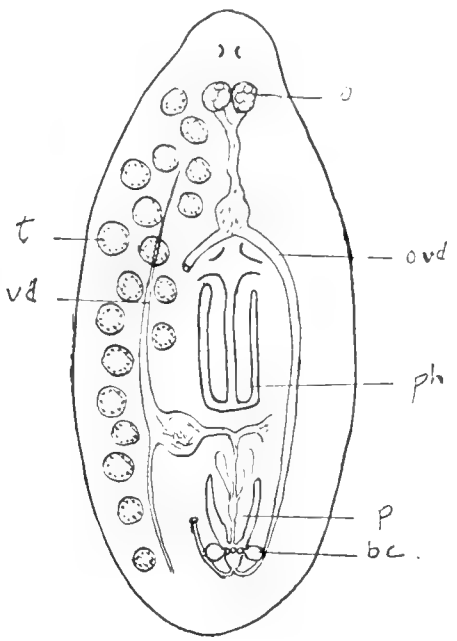


Fig. 6. *P. macquari.* Diagrams showing the reproductive system.

The gut is of the typical triclad arrangement and there is an anterior caecum lying in front of the brain and eyes.

The ovaries lie adjacent to one another and alongside the brain (Figs. 6 and 9). The short ducts running from each ovary join to form a large common ovovitelline duct in the mid-line. This duct then bifurcates, a branch running on either side of the pharynx. The ducts continue posteriorly and open into the small bursae by means of a short, narrow duct which is the reduced ductus spermaticus (Westblad, 1951). (Figs. 10 and 11.) The bursae appears at first to be just a continuation of the ovovitelline ducts as the lumen is only a little larger. However, the cells lining them are more numerous and different from those of the ovoviteline ducts, also there is a layer of circular muscles around the bursae. The bursae open by vaginal pores, one on either side of the genital pore and adjacent to it (Fig. 6). The ovovitelline ducts continue posteriorly to open into the female atrium or vagina (Figs. 6 and 11).

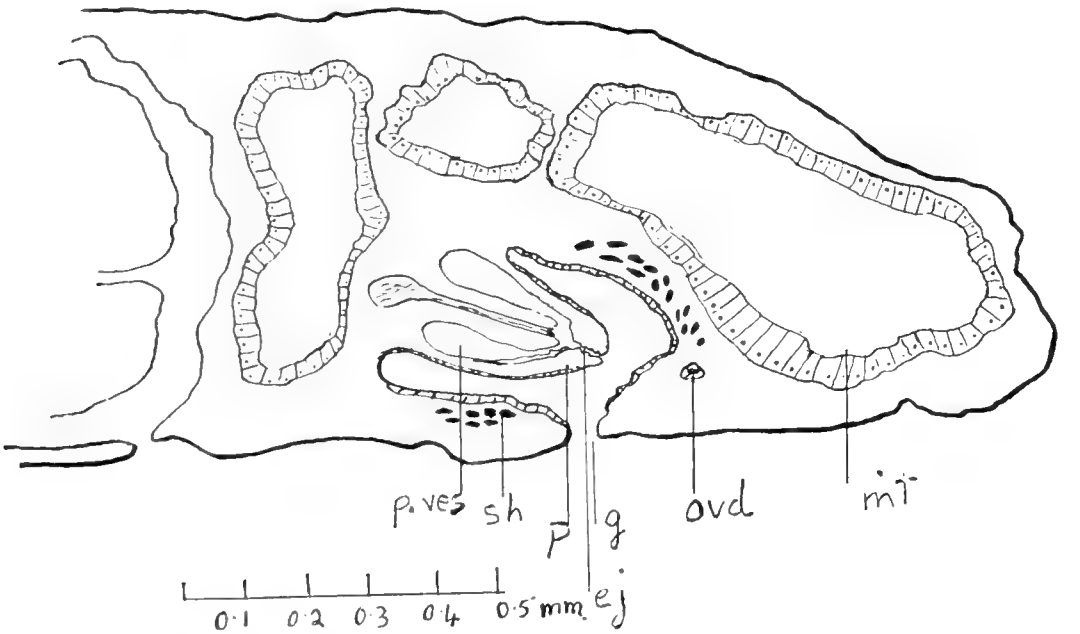


Fig. 7. *P. macquari.* Longitudinal sagittal section through the genital region.

The testes are dorsal and numerous, usually eighteen or more follicles on each side. They extend from the ovary to the region of the genital apparatus. The vasa diferentia swell out to form large sacs which lie on either side of the body. They then run dorsally into the penis bulb as separate ducts, which join towards the base of the bulb to form the common ejaculatory duct. There are large spaces in the penis bulb which also open into the ejaculatory duct. (These may be glandular, though the material was not well enough preserved to distinguish gland cells.) (Fig. 7.)

The arrangement of the bursa (receptaculum seminis), ductus spermaticus and the posterior portion of the ovovitelline duct is very similar to that described by Westblad, 1951, for *Palombiella stephensoni.* The receptacula seminis (bursae cupolatrices) are vesicular and connected with the oviducts, and the testes are numerous. The above described specimen is therefore placed in the genus

Palombiella. It differs from *P. stephensoni* in several important respects: the ovovitelline ducts are united anterior to the pharynx, the testes are dorsal and the ductus spermaticus is extremely short. The specimens have therefore been placed in a new species.

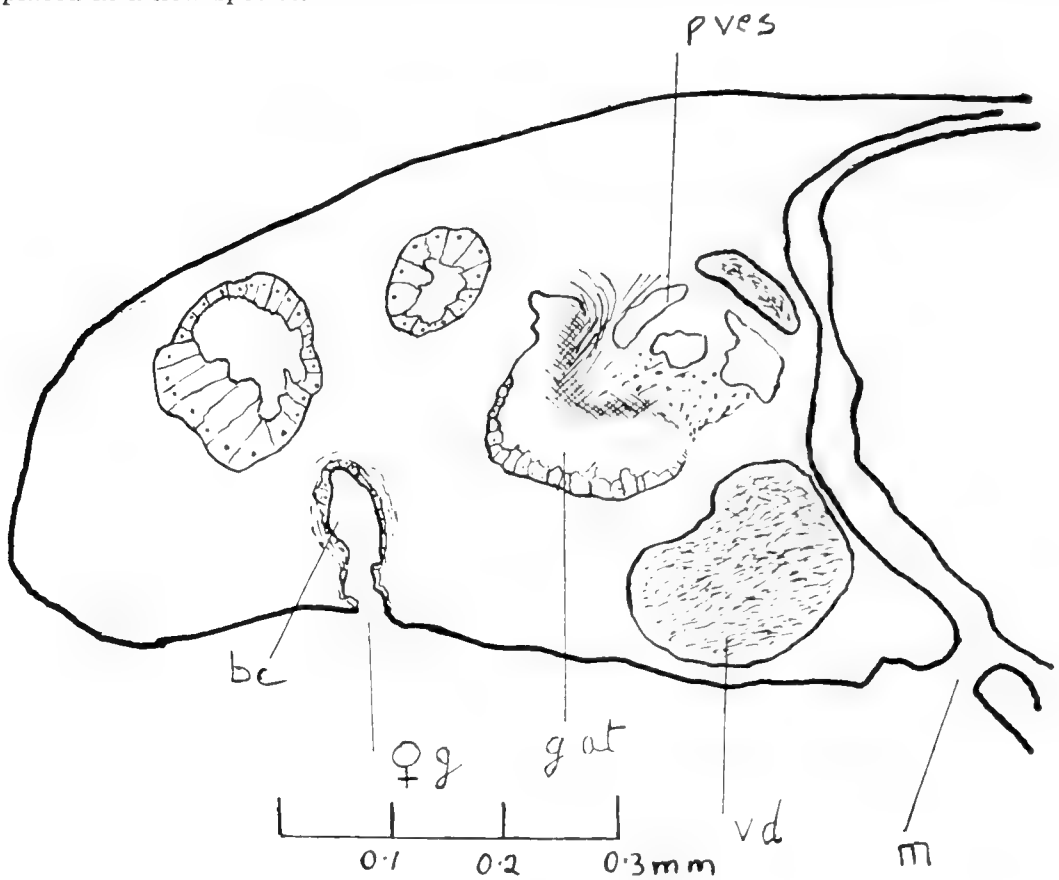


Fig. 8. *P. macquari*. Longitudinal sagittal section through the female genital pore.

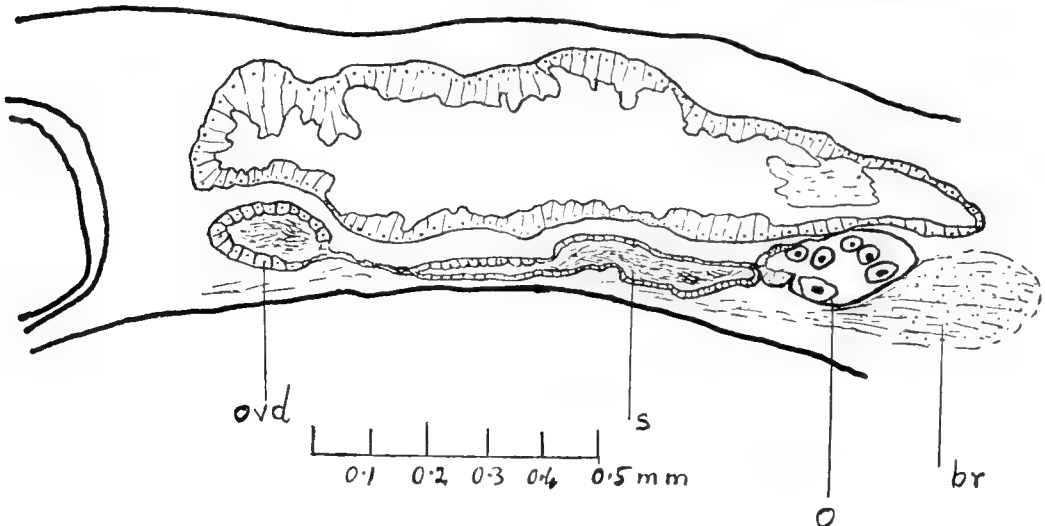


Fig. 9. *P. macquari*. Longitudinal sagittal section through the common ovovitteline duct anterior to the pharynx.

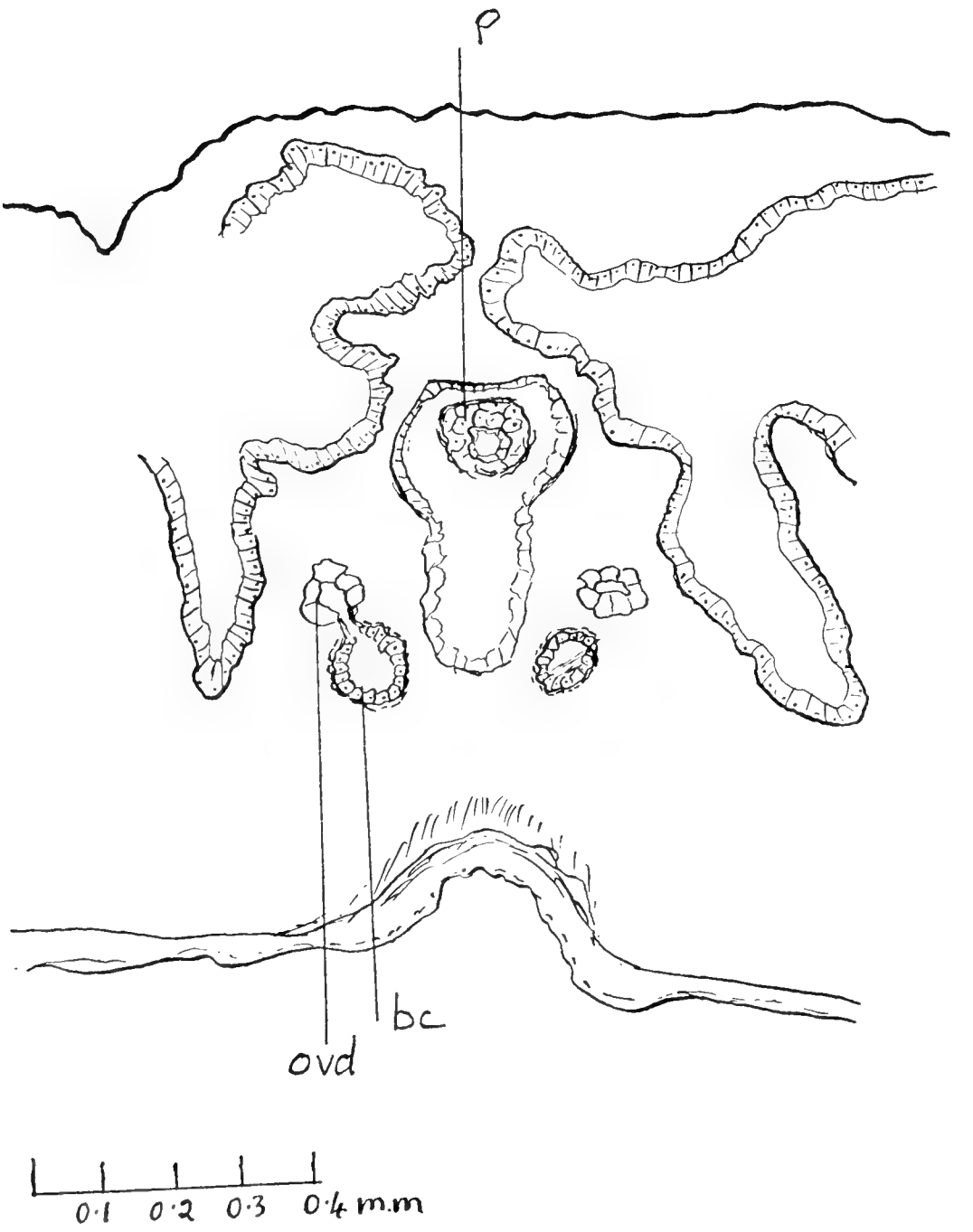


Fig. 10. *P. macquari.* T.S. genital region to show the opening of the ovovitteline duct into the bursa copulatrix.

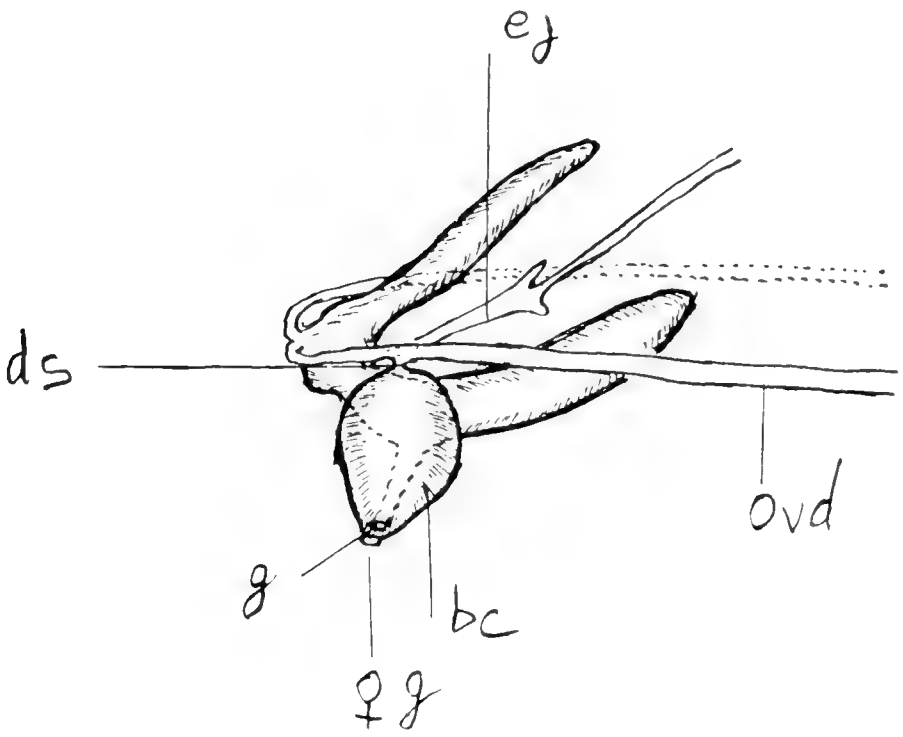


Fig. 11. *P. macquari.* Diagram of the copulatory organs.

2. *Palombiella stevensoni* (Palombi).

MI/49/T7. Nat. Mus. No. G1224. Intertidal zone, reef, southern end Hasselborough Bay. 1 specimen. 3 mm. long.

The upper side is dark grey with irregular patches of pale cream (possibly white in life). Underside pale. Black band across the front end with bands around the eyes. The specimen was not fully mature but the genital pores, of which there were three, were just open. The size, shape and colouration resembles that of *Palombiella stevensoni* as also does the shape and position of the penis. The receptacula seminales were small and immature so it was uncertain whether they were tube shaped or globular. The testes, ducti, spermatici and oviducts could not be identified, so that it was hard to distinguish whether the specimen belonged to the genus *Palombiella* or *Synsiphonium.*

Ciliate protozoa were observed in the pharyngeal cavity and in the intestine similar to those present in *Palombiella stephensoni described by Westblad* (1951).

3. *Synsiphonium liouvilli* Halley.

29/8/49. A.N.A.R.E. Coll. No. 258. Nat. Mus. No. G1231. Under lower littoral rocks, Atlas Cove, Heard Island.

This specimen corresponds exactly to the revised description of *S. liouvilli* given by Westblad (1952).

Station I.A.B. 27/1/49 R.K. Nat. Mus. No. G1232. Bare zone fixed in formalin.

There were three specimens only. One was badly damaged and the other two were immature, so it was not possible to identify them.

30.1.50. N. M. Hayson. MI/49/T4. Nat. Mus. No. G1233. Under rocks water's edge, Buckles Bay. Narcotised with menthol, fixed 70 per cent. Alcohol.

There were five specimens but unfortunately they had dried up by the time they had reached me. An attempt was made to soften them and section them but the results were unsatisfactory so identification was not possible.

MI/49/T5. 9.2.50. N. M. Hayson. Nat. Mus. No. G1234.

Under rocks Lithothamnion zone, reef, Buckles Bay. Fixed in 70 per cent. Alcohol. Length 3·5 mm. Colour cream with a reddish patch on the mid-dorsal surface. Two eyes, pigmented. There was one specimen only which was sectioned. A rhabdocoel.

Ancanthocephala—Echinorhynchus spp.

MI/49/P39. 2.2.50. N. M. Hayson. Nat. Mus. No. G1235.

Intestinal parasites of *Notothenis macrocephala* Buckles Bay.

Summary.

One new species of marine triclad, Fam: Bdellouridae, *Palombiella macquari* is described with seven text figures. Another specimen belonging to the Fam: Bdellouridae, *Synsiphonium liouvilli* is identified. This species has been described from the Antarctic, Ile Petermann (Hallez, 1912, 1913) and Tierra del Fuego (Westblad, 1952).

Four species of *Procerodes* are identified, namely, *P. wandeli, P. hallezi, P. ohlini* and *P. variabilis.* All these are widely distributed in the South American Antarctic region (Westblad, 1952).

References.

Böhmig, L., 1906.—Tricladen–Studien. I. Tricladida maricola. *Zeitsch. f. wiss. zool.* Bd. LXXXI.

Hallez, Paul, 1906.—Note preliminaire sur les triclades maricoles des mers antarctique et du Cap Horn, recueillis par l'expedition charcot. *Bull. Mus. Hist. nat.,* Paris, Vol. 12, pp. 395–399.

Hallez, Paul, 1911.—Un Bdellouride non parasite des mers antarctiques. *C.R. Ac. Sc.,* Vol. 152, p. 461–463.

Hyman, L. H., 1944.—Marine turbellaria from the Atlantic Coast of North America. *Am. Mus. Novit.,* No. 1266, p. 1–15.

Hyman, L. H., 1951.—*The Invertebrates.* V. 2. Platyhelminthes, &c. VII–550 p., 208 figs. New York.

Hyman, L. H., 1954.—A new marine triclad from the Coast of California. *Am. Mus. Novitat.,* No. 1679, p. 1–5.

Marcus, E., 1947.—Turbelarios marinhos do Brasil. *Bol. Fac. Fil. Ci. Letr.* Zoologia No. 12, pp. 99–216, + 1–21. Sao Paulo.

Marcus, E., 1948.—Turbellaria do Brasil. *Bol. Fac. Fil. Ci. Letr. Zoologia* No. 13, pp. 111–243, t. 1–20. Sao Paulo.

Marcus, E., 1952.—*Reports of the Lund University Chile Expedition* 1948–49. II. Turbellaria. Lund.

Marcus, E., 1955.—South African Animal Life. *Results of the Lund University Expedition,* 1950–1951. Turbellaria. Uppsala.

Palombi, A., 1938.—Turbellaria del Sud Africa. *Arch. Zool. Italiano,* V. 25, pp. 368–383.

Westblad, E., 1951.—Tubellarians of Tristan da Cunha. *Res. Norweg. Scient. Exped. to Tristan da Cunha* 1937–38, No. 21, p. 1–8. Oslo.

Westblad, E., 1952.—Turbellaria (excl. Kalyptorhynchia). *Further Zool. Res. Swed. Antarct. Exp.* 1901–1903, V. 4, N. 8, p. 1–55. Stockholm.

Wilhelmi, J., 1909.—Tricladen. Monogr. 32. *Fauna and Flora Jolfes von Neapel.*

ABBREVIATION.

b	=	bursa copulatrix
bc	=	bursa canal
br	=	brain
ds	=	ductus spermaticus
ej	=	ejaculatory duct
g	=	genital pore
gat	=	genital atrium
int	=	intestine
m	=	mouth
o	=	ovary
ovd	=	ovo-vitelline duct (oviduct)
p	=	penis
pb	=	penis bulb
ph	=	pharynx
p.ves	=	penis bulb vesicles
s	=	sperm
sh	=	shell glands
t	=	testes
v	=	vagina.

A PRELIMINARY REPORT ON THE POLYZOA-COLLECTION IN NATIONAL MUSEUM OF VICTORIA, 1961–62.

Imm. Vigeland, University of Oslo, Norway.

INTRODUCTION.

The collection of Polyzoa in National Museum of Victoria includes types, slides, dry material in boxes and spirit-material. Before the material was kept separate in different cabinets, but is now put in systematical and alphabetical order, according to the following papers :—

1. R. S. Bassler : Bryozoa, in Treatise on Invertebrate Paleontology, Geological Society of America and University of Kansas Press, 1953. (Part G, p. 1–253).

2. R. C. Osburn : Bryozoa of the Pacific Coast of America, in Allan Hancock Pacific Expeditions, 1950, 1952, 1953. (Part 1, 2, 3, p. 1–841).

I. *Types.*—Of slides in the small type-cabinet there are 146, but only 107 are true types. (See p. 190).

II. *Slides.*—There are altogether 6,157 slides in 200 drawers. Of the CHEILOSTOMATA, the Ascophora-group fill 96 and the Anasca-group 68 of these 200 drawers. The Orders CYCLOSTOMATA and CTENOSTOMATA are divided into 22 and 6 drawers respectively and includes also a few slides from the Class PHYLACTOLAEMATA and the Subphylum ENTOPROCTA. The 4 remaining drawers includes 313 slides, mostly without localities or indefinable.

All the different species which occur in the collection are mentioned on pages 168–187. On p. 188–9 and p. 191 are in tabular-form given a summary of the families, genera, subgenera, species also arranged alphabetically and after the number of species.

III. *Dry Material in Boxes.*—All the material is housed in 16 drawers in one steel-case.

IV. *Spirit Collection.*—There are 36 glass jars and 9 tubes and practically all material collected in Port Phillip Bay in the last years.

CHEILOSTOMATA.

ANASCA.

Family	Genus	Species	No. of Slides
1. AETEIDAE	*Aetea*	1. *anguina*	6
		2. *dilatata*	21
		3. *dentata*	1
		4. *recta*	13
			41
2. SCRUPARIIDAE ..	*Scruparia* ..	1. *chelata*	7
		2. *clavata*	1
			8
	Eucratea	1. *lafontii*	3
		2. *loricata*	3
		3. *gracilis*	8
			14
3. MEMBRANIPORIDAE ..	*Membranipora* ..	1. *acifera*	1
		2. *americana*	1
		3. *angulosa*	3
		4. *avicularis*	1
		5. *bicolor*	3
		6. *bidens*	1
		7. *capensis*	1
		8. *catenularia*	2
		9. *cervicornis*	5
		10. *deltoidea*	1
		11. *dumerilii*	3
		12. *favosita*	1
		13. *inarmata*	1
		14. *membranacea*	13
		15. *monostachys*	1
		16. *oblonga*	2
		17. *papulifera*	2
		18. *pectinata*	4
		19. *perfragilis*	14
		20. *perminuta*	5
		21. *pouilletii*	1
		22. *praetenuis*	2
		23. *pura*	1
		24. *pustulata*	1
		25. *radicifera*	1
		26. *rosselii*	4
		27. *savarti*	2
		28. *savarti* var.	1
		29. *sejuncta*	1
		30. *serrata*	10
		31. *serrata* var. *acifera* ..	1
		32. *solidula*	2
		33. *sophiae*	5
		34. *tenuispina*	1
		35. *tripuncta*	2
		36. *tuberculata*	6
		37. *umbonata*	3
		sp.	16
			125

Family	Genus	Species	No. of Slides
	Biflustra	1. *aciculata*	3
		2. *bimamillata*	3
		3. *coronata*	1
		4. *delicatula*	6
		5. *jugalis*	1
		6. *papulifera*	8
		7. *sericea*	1
		8. *uncinata*	3
		sp.	3
			29
	Conopeum ..	1. *lacroixii*	25
	Cupuladria ..	1. *canariensis*	1
4. ELECTRINIDAE ..	*Electra*	1. *amplectens*	1
		2. *bellula*	6
		3. *flagellum*	5
		4. *multispinata*	2
		5. *pilosa*	28
		6. *pilosa* var. *dentata* ..	2
		7. *pilosa* var. *multi-spinata*	1
		8. *pilosa* form. *verticillata* ..	8
		9. *pilosa* var.	1
			54
	Pyripora ..	1. *catenularia*	5
		2. *crassa*	5
		3. *polita*	7
		sp.	3
			20
5. FLUSTRIDAE	*Flustra*	1. *armata*	1
		2. *carbasea*	1
		3. *denticulata*	21
		4. *denticulata* var. *quadri*	1
		5. *denticulata* var. ..	1
		6. *dentigera*	1
		7. *dissimilis*	1
		8. *foliacea*	7
		9. *membranacea*	2
		10. *membranacea-truncata* ..	2
		11. *militaris*	2
		12. *nobilis*	1
		13. *papyracea*	8
		14. *reticulum*	7
		15. *securifrons*	1
		16. *serrulata*	3
		17. *spinuligera*	2
		18. *truncata*	1
			63
	Carbasea ..	1. *cribriformis*	1
		2. *cyathiformis*	2
		3. *dissimilis*	11
		4. *elegans*	8
		5. *indivisa*	2
		6. *indivisa* var. *cyathiformis*	4
		7. *pisciformis*	8
		8. *reticulum*	7
			43

Family	Genus	Species	No. of Slides
	Spiralaria ..	1. *florea*	11
6. HINCKSINIDAE ..	*Hincksina* ..	1. *flustroides*	1
		2. *nigrans*	1
			2
	Cauloramphus ..	1. *cymbaeformis*	1
		2. *spiniferum*	1
			2
7. CALLOPORIDAE ..	*Callopora* ..	1. *aurita*	2
		2. *corbula*	9
		3. *lineata*	5
			16
	Alderina	1. *imbellis*	1
	Amphiblestrum ..	1. *albispinum*	12
		2. *argenteum*	9
		3. *bursarium*	15
		4. *cervicornis*	21
		5. *ciliata*	7
		6. *flemingii*	4
		7. *patellarium*	2
		8. *permunitum*	19
		9. *punctigerum*	1
		10. *spinosum*	2
		11. *trifolium*	8
		12. *umbonatum*	4
		sp.	1
			105
	Amphiblestrum (*Bathypora*)	1. *nitens*	10
	Pyrulella	1. *pyrula*	18
	Retevirgula ..	1. *acuta*	4
	Tegella	1. *unicornis* var. *americana*	2
8. HIANTOPORIDAE ..	*Hiantopora* ..	1. *ferox*	17
9. ARACHNOPUSIIDAE ..	*Arachnopusia* ..	1. *monoceros*	3
10. MICROPORIDAE ..	*Micropora* ..	1. *abyssicola*	1
		2. *coriacea*	21
		3. *coriacea* var. *angusta* ..	6
		4. *perforata*	29
		sp.	1
			58
	Caleschara ..	1. *denticulata*	16
		sp.	1
			17
	Selenaria ..	1. *concinna*	1
		2. *maculata*	3
		3. *punctata*	2
		sp.	2
			8

Family	Genus	Species	No. of Slides
11. LUNULITIDAE	*Lunulites*	1. *cancellata*	1
		2. *gibbosa*	1
		3. *incisa*	1
		4. *patelliformis*	1
		5. *repandus*	1
			5
12. STEGINOPORELLIDAE	*Steginoporella* ..	1. *impressa*	1
		2. *magnilabris*	13
		3. *neozelanica*	5
			19
13. THALAMOPORELLIDAE	*Thalamoporella* ..	1. *rosieri*	1
		2. *rosieri* var. *falcifera* ..	1
			2
	Thairopora ..	1. *armata*	3
		2. *cincta*	22
		3. *dispar*	3
		4. *jervoisii*	6
		5. *mamillaris*	16
		6. *sinuata*	1
		7. *whitteli*	2
		8. *woodsii*	7
		sp.	3
			63
14. ASPIDOSTOMATIDAE ..	*Monoporella* ..	1. *crassatina*	2
		2. *lepida*	3
			5
15. COTHURNICELLIDAE ..	*Cothurnicella* ..	1. *cordieri*	13
		2. *dædala*	3
			16
16. ALYSIDIIDAE	*Alysidium* ..	1. *parasitica* ..	2
17. CELLARIIDAE	*Cellaria*	1. *appendiculata*	9
		2. *australis*	14
		3. *bicornis*	6
		4. *borealis*	2
		5. *divaricata*	20
		6. *farciminoides*	2
		7. *fistulosa*	11
		8. *fistulosa* var.	1
		9. *gracilis*	11
		10. *hirsuta*	20
		11. *johnstoniae*	2
		12. *malvinensis*	2
		13. *munita*	3
		14. *ovicellosa*	1
		15. *rigida*	13
		16. *sinuosa*	5
		17. *tenuirostris*	22
		sp.	26
			170

Family	Genus	Species	No. of Slides
18. FARCIMINARIIDAE ..	*Farciminaria* ..	1. *aculeata*	10
		2. *delicatissima*	1
		3. *simplex*	5
		4. *uncinata*	8
		sp.	3
			27
	Didymozoum ..	1. *simplex*	12
	Nellia	1. *occulata*	14
19. BUGULIDAE	*Bugula*	1. *avicularia*	6
		2. *calathus*	2
		3. *cantodon*	1
		4. *cucullata*	13
		5. *dentata*	16
		6. *ditrupae*	1
		7. *flabellata*	2
		8. *fruticosa*	1
		9. *globosa*	1
		10. *murrayana*	1
		11. *neritina*	15
		12. *plumosa*	1
		13. *reticulata*	1
		14. *robusta*	6
		15. *rufa*	1
		16. *simplex*	2
		17. *turbinata*	2
		18. *verticillata*	1
		sp.	1
			74
	Caulibugula ..	1. *annulata*	6
		2. *exilis*	5
		3. *glabra*	11
			22
	Kinetoskias ..	1. sp.	3
20. BICELLARIELLIDAE ..	*Bicellariella* ..	1. *ciliata*	11
		2. *cuculata*	1
		3. *gracilis*	2
		4. *tuba*	33
		5. *turbinata*	9
		6. sp.	1
			57
	Bicellarina ..	1. *alderi*	2
	Cornucopina ..	1. *grandis*	19
		2. *grandis* var. *producta* ..	3
			22
	Dimetopia ..	1. *cornuta*	15
		2. *hirsuta*	3
		3. *hirta*	6
		4. *spicata*	21
		sp.	1
			46

Family	Genus	Species	No. of Slides
21. BEANIIDAE	*Beania*	1. *bilaminata*	3
		2. *conferta*	5
		3. *costata*	20
		4. *crotali*	13
		5. *decumbens*	5
		6. *intermedia*	1
		7. *magellanica*	16
		8. *mirabilis*	3
		9. *radicifera*	4
		10. *spinigera*	16
		11. *wilsoni*	1
		sp.	1
			88
	Diachoris ..	1. *hirtissima*	4
		2. *inermis*	1
		3. *patellaria*	1
		4. *simplex*	2
			8
22. SCRUPOCELLARIIDAE ..	*Scrupocellaria* ..	1. *annectans*	3
		2. *cervicornis*	15
		3. *cyclostoma*	15
		4. *obtecta*	14
		5. *ornithorhynchus* ..	13
		6. *reptans*	3
		7. *scabra*	1
		8. *scrupea*	25
		9. *scruposa*	3
		sp.	1
			93
	Amastigia ..	1. *nuda*	3
	Bugulopsis ..	1. *cuspidata*	18
	Caberea	1. *armata*	1
		2. *boryi*	9
		3. *darwinii*	9
		4. *glabra*	12
		5. *glabra* var. *dolabrata* ..	2
		6. *grandis*	10
		7. *lata*	1
		8. *lyalii*	1
		9. *rostrata*	1
		10. *rudis*	15
		sp.	7
			68
	Canda	1. *arachnoides*	18
		2. *tenuis*	3
		sp.	5
			26
	Craspedozoum ..	1. *ligulatum*	6
		2. *roboratum*	15
		3. *spicatum*	4
		sp.	4
			29

Family	Genus	Species	No. of Slides
	Maplestonia ..	1. *cirrata*	10
		2. *simplex*	9
			19
	Menipea	1. *buskii*	8
		2. *cervicornis*	7
		3. *cirrata*	1
		4. *clausa*	1
		5. *crystallina*	29
		6. *flabellum*	2
		7. *fuegensis*	1
		8. *funiculata*	12
		9. *gracilis*	3
		10. *lata*	1
		11. *occidentalis*	1
		12. *porteri*	14
		13. *smitii*	1
		14. *tricellata*	15
		sp.	6
			102
	Monartron ..	1. *cyathus*	9
	Rhabdozoum ..	1. *wilsoni*	9
	Tricellaria ..	1. *ternata*	3
23. EPISTOMIIDAE.. ..	*Epistomia* ..	1. *bursaria*	6
24. CRIBRILINIDAE ..	*Cribrilina* ..	1. *acantherostris*	1
		2. *acanthoceros*	6
		3. *clithridiata*	4
		4. *cribosa*	2
		5. *gathyae*	2
		6. *gilbertensis*	1
		7. *monoceros*	39
		8. *punctata*	8
		9. *radiata*	18
		10. *radiata* f. *innominata* ..	7
		11. *setirostris*	7
		12. *tubulifera*	1
			96
	Figularia ..	1. *figularis*	8
	Membraniporella ..	1. *distans*	5
		2. *melolontha*	1
		3. *nitida*	9
			15

CHEILOSTOMATA.

ASCOPHORA.

1. PORINIDAE	*Porina*	1. *gracilis*	15
		2. *inversa*	9
		3. *larvalis*	12
		4. *magnirostris*	1
		5. *tubulosa*	1
		sp.	1
			39

Family	Genus	Species	No. of Slides
2. CYCLICOPORIDAE ..	*Cyclicopora* ..	1. *longipora*	8
		sp.	1
			9
3. HIPPOTHOIDAE ..	*Hippothoa* ..	1. *distans*	5
		2. *divaricata*	14
		3. *flagellum*	4
		4. *hyalina*	2
		5. *patagonica*	1
			26
	Chorizopora ..	1. *brogniartii*	20
		2. *vittata*	3
			23
4. UMBONULIDAE ..	*Umbonula* ..	1. *verrucosa*	9
5. PETRALIIDAE	*Petralia*	1. *undata*	14
	Hippopodina ..	1. *feegensis*	2
6. GIGANTOPORIDAE ..	*Gephyrophora* ..	1. *polymorpha*	4
	Spiroporina ..	1. *auriculata*	3
		2. *longirostris*	8
		3. *victoriensis*	2
			13
7. STOMACHETOSELLIDAE	*Stomachetosella* ..	1. *sinuosa*	3
8. SCHIZOPORELLIDAE ..	*Schizoporella* ..	1. *acuminata*	4
		2. *ambita*	1
		3. *anceps*	7
		4. *aperta*	1
		5. *arachnoides*	4
		6. *auriculata*	4
		7. *biaperta* var. *divergens* ..	2
		8. *bimunita*	1
		9. *biturrita*	14
		10. *botryoides*	3
		11. *botryoides* var. ..	1
		12. *cinctipora*	1
		13. *circinata*	5
		14. *complana*	2
		15. *conservata*	3
		16. *cryptostoma*	4
		17. *cribrinata*	1
		18. *discoidea*	1
		19. *divisipora*	2
		20. *dædala*	7
		21. *dædala* var.	1
		22. *ensifera*	1
		23. *fissa*	3
		24. *heteromorpha*	3
		25. *impar*	1
		26. *johnstoni*	1
		27. *lata*	16
		28. *latisinuata*	13
		29. *linearis*	2
		30. *linearis* var. *hastata* ..	1
		31. *maplestonei*	9
		32. *nigrans*	4

Family	Genus	Species	No. of Slides
		33. *nodulifera*	10
		34. *ovata*	1
		35. *pachnoides*	9
		36. *perlata*	1
		37. *phymatopora*	1
		38. *porteri*	3
		39. *pulchra*	2
		40. *punctigera*	17
		41. *ridleyi*	13
		42. *rostrata*	2
		43. *sanguinea*	3
		44. *schizostoma*	19
		45. *signata*	1
		46. *simplex*	1
		47. *smeatoni*	6
		48. *speciosa*	4
		49. *spinifera*	2
		50. *striatula*	11
		51. *subsinuata*	11
		52. *triangula*	18
		53. *triangula* var. ..	2
		54. *unicornis*	7
		55. *unicornis* var. *ansata* ..	1
		56. *variolosa*	1
		57. *vitrea*	4
		58. *vulgaris*	10
		59. *woosteri*	2
		sp.	18
			299
	Arthropoma ..	1. *cecilii*	25
	Emballotheca ..	1. *quadrata*	15
	Schizomavella ..	1. *auriculata*	4
9. HIPPOPORINIDAE ..	*Hippoporina* ..	1. *pertusa*	3
10. EXOCHELLIDAE ..	*Escharoides* ..	1. *sarsii*	1
11. MICROPORELLIDAE ..	*Microporella* ..	1. *bimucronata*	1
		2. *ciliata*	42
		3. *ciliata* var. *personata* ..	3
		4. *ciliata* var. *umbonata* ..	1
		5. *ciliata* var. *vibraculifera*	1
		6. *ciliata* var.	1
		7. *diadema*	17
		8. *diadema* var. *angustipora*	2
		9. *diadema* var. *canaliculata*	16
		10. *diadema* var. *lata* ..	12
		11. *diadema* var. *longispina*	3
		12. *diadema* var. *lunipuncta*	4
		13. *impressa*	4
		14. *impressa* var. *cornuta* ..	3
		15. *impressa* var. *pyriformis*	1
		16. *macropora*	1
		17. *semipunctata*	2
		18. *scandens*	1
		19. *violacea*	7
		20. *violacea* var.	1
		sp.	1
			124

Family	Genus	Species	No. of Slides
	Microporella (*Diporula*)	1. *verrucosa*	3
	Microporella (*Flustramorpha*)	1. *margaritacea*	4
	Fenestrulina ..	1. *malusii*	28
		2. *malusii* var. *personata* ..	1
		3. *malusii* var. *thyreophora*	2
		4. *malusii* var. *umbonata* ..	4
		5. *malussii* var.	2
			37
12. EURYSTOMELLIDAE ..	*Eurystomella* ..	1. *foraminifera*	8
13. MUCRONELLIDAE ..	*Mucronella* ..	1. *amphora*	2
		2. *avicularis*	2
		3. *coccinea*	12
		4. *contorta*	1
		5. *diaphana*	16
		6. *ellerii*	33
		7. *excavata*	16
		8. *fumata*	1
		9. *labiata*	4
		10. *lineata*	1
		11. *lævis*	10
		12. *mentalis*	3
		13. *munita*	12
		14. *pavonella*	1
		15. *peachii*	11
		16. *pepillifera*	6
		17. *præstans*	6
		18. *pulvinata*	1
		19. *sincera*	2
		20. *spinosissima*	2
		21. *tricuspis*	30
		22. *tricuspis* var.	2
		23. *variolosa*	5
		24. *vasiformis*	1
		25. *vultur*	22
		26. *vultur* var.	1
		sp.	7
			208
	Palmicellaria ..	1. *elegans*	1
		2. *skenei*	2
			3
	Parasmittina ..	1. *trispinosa*	68
		2. *trispinosa* var. *bimucronata*	2
		3. *trispinosa* var. *nitida* ..	4
		4. *trispinosa* var. ..	2
		..	76
	Porella	1. *argentea*	2
		2. *cervicornis*	4
		3. *compressa*	
		4. *concinna*	6
		5. *elegantula*	1
		6. *formosa*	6
		7. *marsupium*	27

Family	Genus	Species	No. of Slides
		8. *minuta*	2
		9. *nodulifera*	1
		10. *papillifera*	6
		11. *struma*	3
		sp.	5
			65
	Rhamphostomella ..	1. *costata*	4
		2. *orata*	1
		3. *spicata*	1
			6
	Smittina	1. *arcata*	8
		2. *biaricularis*	3
		3. *cheilostoma*	1
		4. *cribraria*	6
		5. *denticulata*	14
		6. *insignis*	2
		7. *landsborovi*	48
		8. *landsborovi* var. *oculata*	36
		9. *landsborovi* var. ..	1
		10. *legentilii*	1
		11. *malleolus*	3
		12. *munita*	1
		13. *nitida*	2
		14. *obscura*	3
		15. *palmata*	3
		16. *propinqua*	6
		17. *unispinosa*	1
		sp.	8
			147
	Smittoidea ..	1. *reticulata*	3
		2. *reticulata* var. *calceolus* ..	7
		3. *reticulata* var. *spatulata*	16
			26
14. TUBUCELLARIIDAE ..	*Tubucellaria* ..	1. *cereoides*	9
		2. *hirsuta*	12
		3. *opuntioides*	7
			28
	Tubiporella ..	1. *magnirostris*	5
		sp.	17
			22
15. RETEPORIDAE.. ..	*Retepora*	1. *aurantiacea*	13
		2. *avicularis*	17
		3. *beaniara*	4
		4. *carinata*	2
		5. *cellulosa*	6
		6. *conchii*	2
		7. *formosa*	13
		8. *granulata*	12
		9. *phenicea*	12
		10. *porcellana*	30

Family	Genus	Species	No. of Slides
		11. *porcellana* var. *laxa* ..	3
		12. *producta*	15
		13. *sinuosa*	1
		14. *solanderi*	1
		15. *surrata*	2
		16. *tubulata*	7
		17. *wallichiana*	5
		18. *worsleyi*	2
		sp.	53
			200
	Rhynchozoon ..	1. *bispinosa*	54
		2. *delicatula*	2
		3. *longirostrum*	23
		4. *profunda*	1
		sp.	15
			95
	Schizoretepora ..	1. *tesselata*	14
	Schizotheca ..	1. *fissa*	32
	Triphyllozoon ..	1. *monilifera*	24
		2. *monilifera* f. *arcuata* ..	5
		3. *monilifera* f. *munita* ..	4
		4. *monilifera* f.m. v. *acuti-rostris*	15
		5. *monilifera* f.m. v. *lunata*	16
		6. *monilifera* f. *sinuata* ..	10
		7. *monilifera* f. *umbonata*	7
			81
16 ADEONIDAE	*Adeona*	1. *albida*	4
		2. *albida* var. *avicularis* ..	3
		3. *grisea*	12
		4. *obligera*	1
		5. *wilsoni*	6
		sp.	11
			37
	Adeonella ..	1. *australis*	18
		2. *cellulosa*	13
		3. *cribripuncta*	2
		4. *dispar*	5
		5. *implexa*	7
		6. *latipuncta*	16
		7. *mucronata*	27
		8. *mucronata* var. *cellulosa*	6
		9. *mucronata* var. *decumbens*	1
		10. *mucronata* var. ..	5
		11. *parvipuncta*	18
		12. *platalea*	15
		13. *polystomella*	4
		sp.	2
			139
	Adeonellopsis ..	1. *foliacea*	20
		2. *foliacea* var. *bidentata* ..	1
		3. *zietzii*	1
		sp.	8
			30

Family	Genus	Species	No. of Slides
	Bracebridgia ..	1. *pyriformis*	14
	Triporula ..	1. *stellata*	9
17. CHEILOPORINIDAE ..	*Cryptosula* ..	1. *pallasiana*	24
	Diploecium ..	1. *simplex*	1
	Hippaliosina ..	1. *rostrigera*	2
	Hippopodinella ..	1. *adpressa*	2
	Watersipora ..	1. *cucullata*	3
18. PARMULARIIDAE ..	*Parmularia* ..	1. *obliqua*	3
19. PHYLACTELLIDAE ..	*Phylactella* ..	1. *collaris*	1
		2. *labrosa*	1
			2
	Lagenipora ..	1. *edwardei*	1
		2. *nitens*	1
		3. *simplex*	1
		4. *socialis*	2
		5. *tuberculata*	4
			9
20. CREPIDACANTHIDAE ..	*Mastigophorella* ..	1. *hyndmanni*	1
		2. *pes anseris*	1
			2
21. CELLEPORIDAE ..	*Cellepora* ..	1. *albirostris*	16
		2. *armata*	1
		3. *avicularis*	1
		4. *benemunita*	1
		5. *bicornis*	1
		6. *bispinata*	20
		7. *bispinosa*	1
		8. *cellulosa*	2
		9. *cidaris*	6
		10. *costata*	25
		11. *delicatula*	1
		12. *diadema*	1
		13. *eytoni*	1
		14. *exigua*	1
		15. *fistulosa*	1
		16. *foliata*	6
		17. *fusca*	2
		18. *glomerata*	3
		19. *glomerulata*	2
		20. *granum*	1
		21. *hastigera*	3
		22. *hysterix*	1
		23. *incrassata*	1
		24. *intermedia*	3
		25. *lirata*	13
		26. *longirostris*	1
		27. *magnirostris*	7
		28. *mamillata*	2
		29. *megasoma*	4
		30. *munita*	7
		31. *platalea*	4
		32. *prolifera*	4
		33. *pumicosa*	8
		34. *rota*	3
		35. *serratirostris*	5

Family	Genus	Species	No. of Slides
		36. *signata*	3
		37. *simplex*	6
		38. *speciosa*	1
		39. *spicata*	6
		40. *tiara*	4
		41. *tridenticulata*	5
		42. *variolosa*	1
		43. *verrucosa*	8
		44. *vitrea*	3
		sp.	133
			329
	Costazia	1. *costazii*	6
	Harmerella ..	1. *dichotoma*	1
	Omalosecosa ..	1. *ramulosa*	4
	Schismopora ..	1. *cucullata*	1
22. PASYTHEIDAE ..	*Pasythea* ..	1. *pasythea*	1
		2. *tubulifera*	2
			3
23. CATENICELLIDAE ..	*Catenicella* ..	1. *amphora*	7
		2. *bicornis*	1
		3. *buskii*	11
		4. *carinata*	10
		5. *concinna*	1
		6. *cribraria*	21
		7. *crystallina*	8
		8. *formosa*	18
		9. *fusca*	15
		10. *gemella*	8
		11. *gibbosa*	1
		12. *gracilenta*	9
		13. *hannafordi*	8
		14. *hastata*	65
		15. *hastata* var. *sculpta* ..	1
		16. *intermedia*	12
		17. *lorica*	11
		18. *margaritacea*	28
		19. *perforata*	20
		20. *pyriformis*	1
		21. *ringens*	1
		22. *umbonata*	14
		23. *urnula*	13
		24. *utriculus*	8
		25. *ventricosa*	29
		26. *venusta*	2
		27. *wilsoni*	8
		sp.	13
			344
	Calpidium ..	1. *ornatum*	11
		2. *ponderosum*	15
			26
	Catenicellopsis ..	1. *delicatula*	17
		2. *pusilla*	15
		sp.	1
			33

Family	Genus	Species	No. of Slides
	Claviporella ..	1. *aurita*	22
		2. *dawsoni*	8
		3. *geminata*	11
		4. *imperforata*	9
		5. *pulchra*	2
		sp.	3
			55
	Cornuticella ..	1. *cornuta*	13
	Cribricellina ..	1. *rufa*	14
	Pterocella ..	1. *alata*	15
	Scuticella	1. *plagiostoma*	18
		2. *plagiostoma* var. *setigera*	1
		3. *plagiostoma* var. *setosa*	2
		4. *urnula*	1
			22
	Strongylopora ..	1. *pulchella*	9
	Vittaticella ..	1. *elegans*	29
		2. *utriculus*	30
			59
24. ONCHOPORIDAE ..	*Onchopora* ..	1. *hirsuta*	3
		2. *immersa*	1
		3. *mutica*	1
		4. *sinclairii*	5
		sp.	1
			11
	Calwellia ..	1. *bicornis*	30
		2. *gracilis*	5
			35
	Onchoporella ..	1. *bombycina*	1
25. EUTHYRISELLIDAE ..	*Euthyrisella* ..	1. *episcopalis*	6
		2. *obtecta*	1
		3. *woosteri*	1
			8
	Urceolipora ..	1. *dentata*	15
		2. *nana*	10
			25
26. CONESCHARELLIDAE ..	*Bipora*	1. *angulopora*	2
		2. *biarmata*	1
		3. *elegans*	1
		4. *multiarmata*	3
		5. *philippiensis*	4
		sp.	1
			12
27. MYRIOZOIDAE ..	*Myriozoum* ..	1. *subgracilis*	4
		2. *truncata*	2
			6

Family	Genus	Species	No. of Slides
28. LEKYTHOPORIDAE ..	*Lekythopora* ..	1. *hysterix*	15
		sp.	1
			16
	Poecilopora ..	1. *anomala*	5
	PHYLACTOLAEMATA		
	Fredericella ..	1. *sp.*	1
	Plumatella ..	1. sp.	1
	CYCLOSTOMATA.		
1. CRISIIDAE	*Crisia*	1. *acropora*	29
		2. *biciliata*	15
		3. *cornuta*	2
		4. *denticulata*	8
		5. *eburnea*	9
		6. *edwardsiana*	21
		7. *fistulosa*	6
		8. *margaritacea*	4
		9. *ramosa*	5
		10. *setosa*	10
		11. *tenuis*	14
		sp.	9
			132
2. DIASTOPORIDAE ..	*Diastopora* ..	1. *bicolor*	2
		2. *capitata*	2
		3. *concinna*	4
		4. *connata*	6
		5. *cristata*	14
		6. *lineata*	1
		7. *megastoma*	1
		8. *obelia*	2
		9. *patina*	6
		10. *sarniensis*	9
		11. *torquata*	7
		sp.	7
			61
	Reticulipora ..	1. *dorsalis*	2
	Stomatopora ..	1. *dilatans*	1
		2. *geminata*	1
		3. *granulata*	1
		4. *johnstoni*	1
		5. *major*	2
			6
3. TUBULIPORIDAE ..	*Tubulipora* ..	1. *clavata*	4
		2. *concinna*	2
		3. *connata*	1
		4. *corrugata*	1
		5. *flabellaris*	5
		6. *hirsuta*	1
		7. *lobulata*	2
		8. *lucida*	6
		9. *modesta*	1
		10. *pulchra*	26
		11. *serpens*	3
		sp.	13
			65

Family	Genus	Species	No. of Slides
	Idmonea	1. *atlantica*	20
		2. *australis*	10
		3. *contorta*	9
		4. *gasparensis*	4
		5. *interjuncta*	8
		6. *irregularis*	3
		7. *milneana*	12
		8. *radians*	15
		9. *ramosa*	3
		10. *serpens*	6
		11. *torquata*	2
		sp.	5
			97
4. ONCOUSOECIIDAE ..	*Filisparsa* ..	1. *delvausci*	2
		2. *varians*	1
			3
5. ENTALOPHORIDAE ..	*Entalophora* ..	1. *australis*	28
		2. *clavata*	2
		3. *fragilis*	1
		4. *intricaria*	2
		5. *parasitica*	1
		6. *proboscidea*	9
		7. *regularis*	2
		8. *rugosa*	2
		9. *wanganuiensis* ..	1
		sp.	2
			50
	Pustulopora ..	1. *deflexa*	1
		2. *gracilis*	1
		3. *subverticillata*	1
		sp.	1
			4
6. PLAGIOECIIDAE ..	*Liripora*	1. *fasciculata*	1
		2. *lineata*	10
		sp.	1
			12
7. FRONDIPORIDAE ..	*Frondipora* ..	1. *verrucosa*	3
	Fasciculipora ..	1. *bellis*	1
		2. *fruticosa*	6
		3. *gracilis*	9
		4. *lævis*	1
		5. *ramosa*	2
		sp.	2
			21

Family	Genus	Species	No. of Slides
8. HORNERIDAE	*Meandropora* ..	1. *tubipora*	2
	Hornera	1. *fissurata*	1
		2. *foliacea*	28
		3. *frondiculata*	3
		4. *lichenoides*	24
		5. *ramosa*	2
		6. *robusta*	8
		sp.	2
			68
9. CYTIDIDAE	*Supercytis* ..	1. *digitata*	1
10. HETEROPORIDAE ..	*Densipora* ..	1. *corrugata*	21
	Heteroporella ..	1. *radiata*	1
11. TRETOCYCLOECIIDAE ..	*Alveolaria* ..	1. *semiovata*	1
12. LICHENOPORIDAE ..	*Lichenopora* ..	1. *bullata*	3
		2. *californica*	4
		3. *echinata*	32
		4. *echinata* var. *angulata* ..	1
		5. *echinata* var.	1
		6. *fimbriata*	4
		7. *hispida*	8
		8. *holdsworthi*	10
		9. *lagenifera*	1
		10. *magnifica*	10
		11. *pristis*	13
		12. *radiata*	20
		13. *reticulata*	5
		14. *verrucaria*	5
		15. *victoriensis*	3
		16. *wilsoni*	24
		17. *wilsoni* var.	16
		sp.	11
			174
	Lichenopora (*Domopora*)	1. *lucernaria*	1
	Lichenopora (*Radiopora*)	1. sp.	1
	Disporella ..	1. *californica*	1
		2. *ciliata*	2
		3. *complicata*	1
		4. *grignonensis*	1
		5. *nova-zealandiae* ..	2
		6. *porosa*	1
		7. *tridentata*	1
		sp.	4
			13
	Favosipora ..	1. *rugosa*	3
		sp.	1
			4
	Flosculipora ..	1. *pygmaea*	6
			1
13. SEMICEIIDAE	*Filicea*	1. *elegans*	1
		2. *elegans* var. *areolata* ..	
			2

Family	Genus	Species	No. of Slides
14. FENESTELLIDAE ..	*Fenestella* ..	1. *plebeia*	1
		2. *tuberculo-cannata* ..	1
			2

CTENOSTOMATA.

1. ALCYONIDIIDAE ..	*Lobiancopora* ..	1. *hyalina*	1
2. FLUSTRELLIDRIDAE ..	*Flustrellidra* ..	1. *cylindrica*	1
		2. *dichotoma*	4
		3. *hispida*	2
			7
	Pherusa	1. *tubulosa*	2
3. NOLELLIDAE	*Nolella*	1. *gigantcum*	1
4. VESICULARIDAE ..	*Vesicularia* ..	1. *spinosa*	1
	Bowerbankia ..	1. *caudata* and *imbricata* ..	1
		2. *citrina*	1
		3. *imbricata* and *gracillima*	1
		4. *pustulosa*	1
			4
	Amathia	1. *acervata*	1
		2. *australis*	12
		3. *bicornis*	9
		4. *biseriata*	7
		5. *brogniarti*	2
		6. *connesca*	1
		7. *convoluta*	2
		8. *cornuta*	4
		9. *crispa*	1
		10. *distans*	1
		11. *inarmata*	11
		12. *lendigera*	8
		13. *obliqua*	2
		14. *pinnata*	4
		15. *plumosa*	1
		16. *spiralaria*	2
		17. *spiralis*	3
		18. *tortuosa*	15
		19. *wilsoni*	9
		20. *woodsii*	2
		sp.	28
			125
	Zoobotryon ..	1. *pellucidum*	1
5. WALKERIIDAE ..	*Walkeria* ..	1. sp.	1

ENTOPROCTA.

1. LOXOSOMATIDAE ..	*Loxosoma* ..	1. *crassicauda*	1
		2. *leptoclini*	2
		3. *tethyal*	1
			4
2. PEDICELLINIDAE ..	*Pedicellina* ..	1. *cernua*	1
	Barentsia ..	1. *gracilis*	1
	Pedicellinopsis ..	1. *fruticosa*	4

Unrecognized and undeterminable slides of LEPRALIA.

		No. of Slides
1.	*Lepralia angusta*	1
2.	,, *baccata*	2
3.	,, *bowerbankiana*	1
4.	,, *centrota*	1
5.	,, *chelodon*	3
6.	,, *crassa*	1
7.	,, *craticula*	1
8.	,, *elegans*	9
9.	,, *elimata*	2
10.	,, *incrassata*	1
11.	,, *infundibulata*	1
12.	,, *lateralis*	1
13.	,, *lobata*	1
14.	,, *morrisiana*	1
15.	,, *nodosa*	2
16.	,, *palvinata*	1
17.	,, *poissonii*	6
18.	,, *pyriformis*	1
19.	,, *retilinsata*	1
20.	,, *reussiana*	1
21.	,, *sanguienolenta*	1
22.	,, *setigera*	9
23.	,, *subimmersa*	10
24.	,, *tuberosa*	2
25.	,, *vestita*	1
	,, sp.	18
		79

CHEILOSTOMATA—systematically arranged.

Anasca.

Families	Genera	Subgenera	Species	Slides
1. Aeteidae	1	..	4	41
2. Scruparidae	2	..	5	22
3. Membraniporidae	4	..	47	180
4. Electrinidae	2	..	12	74
5. Flustridae	3	..	27	117
6. Hincksinidae	2	..	4	4
7. Calloporidae	6	1	20	156
8. Hiantoporidae	1	..	1	17
9. Arachnopusiidae	1	..	1	3
10. Microporidae	3	..	8	83
11. Lumulitidae	1	..	5	5
12. Steginoporellidae	1	..	3	19
13. Thalamoporellidae	2	..	10	63
14. Aspidostomatidae	1	..	2	5
15. Cothurnicellidae	1	..	2	16
16. Alysidiidae	1	..	1	2
17. Cellariidae	1	..	17	170
18. Farciminariidae	3	..	6	53
19. Bugulidae	3	..	22	99
20. Bicellariellidae	4	..	12	127
21. Beaniidae	2	..	15	96
22. Scrupocellariidae	11	..	45	379
23. Epistomiidae	1	..	1	6
24. Cribrilinidae	3	..	16	119
	60	1	286	1,856

Ascophora.

1. Porinidae	1	..	5	39
2. Cyclicoporidae	1	..	1	9
3. Hippothoidae	2	..	7	49
4. Umbonulidae	1	..	1	9
5. Petraliidae	2	..	2	16
6. Gigantoporidae	2	..	4	17
7. Stomachetosellidae	1	..	1	3
8. Schizoporellidae	4	..	66	347
9. Hippoporinidae	1	..	1	3
10. Exochellidae	1	..	1	1
11. Microporellidae	2	2	27	168
12. Eurystomellidae	1	..	1	8
13. Mucronellidae	7	..	66	531
14. Tubucellariidae	2	..	4	50
15. Reteporidae	5	..	31	422
16. Adeonidae	5	..	23	229
17. Cheiloporinidae	5	..	5	32
18. Parmulariidae	1	..	1	3
19. Phylactellidae	2	..	7	11
20. Crepidacanthidae	1	..	2	2
21. Celleporidae	5	..	48	341
22. Pasytheidae	1	..	2	3
23. Catenicellidae	10	..	48	590
24. Onchoporidae	3	..	7	47
25. Euthyrisellidae	2	..	5	33
26. Conescharellinidae	1	..	5	12
27. Myriozoidae	1	..	2	6
28. Lekythoporidae	2	..	2	21
	72	2	375	3,002

CHEILOSTOMATA.

Alphabetically	No. of Species	
1. Adeonidae	1. Mucronellidae	66
2. Aeteidae	2. Schizoporellidae	66
3. Alysidiidae	3. Catenicellidae	48
4. Arachnopusiidae	4. Celleporidae	48
5. Aspidostomatidae	5. Membraniporidae	47
6. Beaniidae	6. Scrupocellariidae	45
7. Bicellariellidae	7. Reteporidae	31
8. Bugulidae	8. Flustridae	27
9. Calloporidae	9. Microporellidae	27
10. Catenicellidae	10. Adeonidae	23
11. Cellariidae	11. Bugulidae	22
12. Celleporidae	12. Calloporidae	20
13. Cheiloporinidae	13. Cellariidae	17
14. Conescharellinidae	14. Cribrilinidae	16
15. Cothurnicellidae	15. Beaniidae	15
16. Crepidacanthidae	16. Bicellariellidae	12
17. Cribrilinidae	17. Electrinidae	12
18. Cyclicoporidae	18. Thalamoporellidae	10
19. Electrinidae	19. Microporidae	8
20. Epistomidae	20. Hippothoidae	7
21. Eurystomellidae	21. Onchoporidae	7
22. Euthyrisellidae	22. Phylactellidae	7
23. Exochellidae	23. Farciminariidae	6
24. Farciminariidae	24. Cheiloporinidae	5
25. Flustridae	25. Conescharellinidae	5
26. Gigantoporidae	26. Euthyrisellidae	5
27. Hiantoporidae	27. Lunulitidae	5
28. Hincksinidae	28. Porinidae	5
29. Hippoporinidae	29. Scrupariidae	5
30. Hippothoidae	30. Aeteidae	4
31. Lekythoporidae	31. Gigantoporidae	4
32. Lunulitidae	32. Hincksinidae	4
33. Membraniporidae	33. Tubucellariidae	4
34. Microporellidae	34. Steginoporellidae	3
35. Microporidae	35. Aspidostomatidae	2
36. Mucronellidae	36. Cothurnicellidae	2
37. Myriozoidae	37. Crepidacanthidae	2
38. Onchoporidae	38. Lekythoporidae	2
39. Parmulariidae	39. Myriozoidae	2
40. Pasytheidae	40. Pasytheidae	2
41. Petraliidae	41. Petraliidae	2
42. Phylactellidae	42. Alysidiidae	1
43. Porinidae	43. Arachnopusiidae	1
44. Reteporinidae	44. Cyclicoporidae	1
45. Schizoporellidae	45. Epistomidae	1
46. Scrupariidae	46. Eurystomellidae	1
47. Scrupocellariidae	47. Exochellidae	1
48. Steginoporellidae	48. Hiantoporidae	1
49. Stomachetosellidae	49. Hippoporinidae	1
50. Thalamoporellidae	50. Parmulariidae	1
51. Tubucellariidae	51. Stomachetosellidae	1
52. Umbonulidae	52. Umbonulidae	1
		661

Types of polyzoa: alphabetically.

No. of Slides	in Drawer No.	No. of Slides	in Drawer No.
1. Alysidium inornata	3	1. Membraniporella distans	3
1. Amastigia nuda	3	1. Microporella falcifera	5
1. Bicellaria pectogemma	3	1. Microporella irregularis	5
3. Bicrisia warnamboolensis	7	1. Mucronella centrota	5
1. Bipora ampulla	6	1. Mucronella excavata: praestans ..	5
1. Bipora biarmata	6	1. Mucronella ovifera	5
1. Bipora magniasmata	6	1. Mucronella rugata	5
1. Bipora multiarmata	6	1. Mucronella umbonata	5
1. Caberea grandis	3	1. Parmularia obliqua	5
1. Carbasea indivisa v. cythiformis ..	2	1. Pollaploecium gilbertensis ..	5
1. Catenaria infundibuliformis ..	6	1. Porella papillifera	5
3. Catenicella matthewi	6	1. Retepora avicularis	5
1. Cellepora crenulata	5	1. Retepora monilifera f. umbonata ..	5
1. Cellepora glomerata	5	1. Salicornaria hirsuta	3
1. Cellepora tiara	5	2. Schismopora cucullata	5, 6
1. Cellepora verticalis	5	1. Schizoporella baccata	4
1. Chiastosella daedala	4	1. Schizoporella complanata	4
1. Chiastosella gabrieli	5	1. Schizoporella exsifera	4
1. Claviporella goldsteini	6	1. Schizoporella gibberula	4
1. Cribrilina gilbertensis	3	1. Schizoporella granulata	4
1. Crisia cuneata	6	2. Schizoporella heteromorpha ..	4
1. Crisia howensis	6	1. Schizoporella nitida	4
1. Digenopora latissima	6	1. Schizoporella perarmata	4
1. Dimorphocella portmarina	5	1. Schizoporella perlata	4
1. Flustra dentata	2	1. Schizoporella porifera	4
1. Haswellia longirostris	4	1. Scrupocellaria gilbertensis ..	3
1. Hiantopora corniculata	2	1. Scuticella subventricosa	6
1. Hiantopora corrugata	2	2. Selenaria bimorphosella	2
7. Hippothoa distans	3, 4	1. Selenaria hexagonalis	2
2. Lepralia Cecilii	7	1. Selenaria partipunctata	2
1. Lepralia circinata	7	1. Steganoporella minuta	2
1. Lepralia diaphana	7	1. Steganoporella posteri	2
3. Lepralia larvalis	7	4. Tessarodoma magnirostris ..	4
1. Lepralia marsupium	7	1. Thalamoporella cincta	3
1. Lepralia meavata	7	1. Thalamoporella jervoisii	3
2. Lepralia setigera	7	1. Thalamoporella howensis	3
1. Lepralia trispinosa	7	1. Vittaticella castauca	6
1. Lepralia vitrea	7	1. Vittaticella elegans robusta ..	6
1. Megapora gilbertensis	3	1. Vittaticella utriculus	6
7. Membranipora papulifera	2	1. Zeuglopora lanceolata	6
1. Membranipora woodsii	2		

Altogether: 107 slides.

Slides.

Families	Genera	Subgenera	Species	Slides
CYCLOSTOMATA.				
1. Crisiidae	1	..	11	132
2. Diastoporidae	3	..	17	69
3. Tubuliporidae	2	..	22	162
4. Oncousoeciidae	1	..	2	3
5. Entalophoridae	2	..	12	54
6. Plagioeciidae	1	..	2	12
7. Frondiporidae	3	..	7	26
8. Horneridae	1	..	6	68
9. Cytididae	1	..	1	1
10. Heteroporidae	2	..	2	20
11. Tretocycloeciidae	1	..	1	1
12. Lichenoporidae	4	2	28	196
13. Semieciidae	1	..	2	2
14. Fenestellidae	1	..	2	2
	21	2	115	748
CTENOSTOMATA.				
1. Alcyonidiidae	1	..	1	1
2. Flustrellidridae	2	..	4	9
3. Nolellidae	1	..	1	1
4. Vesiculariidae	4	..	26	131
5. Walkeriidae	1	..	1	1
	9	..	33	143
PHYLACTOLAEMATA.				
1. Fredericellidae	1	..	1	1
2. Plumatellidae	1	..	1	1
	2	..	2	2
CHEILOSTOMATA.				
52. Families	132	3	661	4,858
Lepralia	..	..	..	79
Miscellaneous	..	..	..	313
	132	3	661	5,250
ENTOPROCTA.				
1. Loxosomatidae	1	..	3	4
2. Pedicellinidae	3	..	3	6
	4	..	6	10

INDEX.

Polyzoa in National Museum of Victoria, alphabetically. (Numbers refer to pages in this report.) Synonyms in brackets [ ].

INDEX—*continued.*

INDEX—*continued.*

INDEX—*continued.*

INDEX—*continued.*

INDEX—*continued*

INDEX—*continued.*

INDEX—*continued.*

QUEENSLAND HARPOONS AND THEIR DISTRIBUTION.

Aldo Massola, Curator of Anthropology, National Museum of Victoria.

Harpoons were in use amongst the native tribes of Queensland for the capture of dugong and turtle, before the white man arrived. Cook (1773), King (1827), Macgillivray (1852) and most other early voyagers made special reference to them. Later, competent investigators like Roth (1904), and Thomson (1934) described the technology of harpoons, and the latter recorded the magic and ritual connected with their use.

In comparing these reports it becomes apparent that there were differences in the harpoons employed in different localities, and that these differences were great enough to warrant study. In the present paper these variances are noted, and the distribution of each indicated.

Harpoons, were, and are, in use in many parts of the world, but are specifically an implement of the Pacific Basin and the North American continent. Their original source and distribution centre, as far as the Pacific is concerned, appears to have been Japan, where harpoon heads are common in archaeological assemblages dating from the Middle Jömon Period of the Neolithic (Kidder, 1959). At this time dugout canoes made their appearance in Japan, and salmon became a main source of subsistence. No doubt the harpoons were used in taking the latter.

The nearest locality to Australia where harpoons were employed is the islands of Torres Strait, where they were made at, and distributed from, the island of Muralug (Haddon, 1912). The Torres Strait Islanders were in constant contact with the natives of Cape York Peninsula (Moseley, 1879), and it is possible that the Queensland harpoon was greatly influenced, if not introduced, by them.

Harpoons consist of a pointed head loosely inserted in a terminal hole scooped into the thick distal end of a tapering shaft about 12 or 15 feet in length. At the present day this head is lashed on to a long rope, or running line, the other end of which is made fast to the canoe. When near enough to the quarry the hunter jumps into the water towards it, and adds his weight to the thrust, while transfixing his victim. Upon being struck the animal dives, the harpoon head penetrates its flesh and becomes dislodged from its socket in the shaft, which is still held by the native, who then regains the canoe after his dip. The head being lashed to the canoe holds the animal until safely secured.

In the old days, however, according to early navigators' records, the end of the line was lashed on to the shaft, or a small wooden shield, and not to the canoe. This enabled the shaft, after the head left it, to act as a float, thus indicating the underwater position of the dugong or turtle. The canoe was then paddled after the float, and upon the animal coming to the surface to breathe it would be despatched with an ordinary spear. The new method was apparently adopted with the change-over from the wooden barbed head to the European wire head devoid of barbs, which is now in use. The change in method became necessary because the unbarbed head would not allow for any great pull, and the hunter being in the water, was often able to tie an extra line onto the quarry, or even lay hold of it. It is interesting to note that the new method was the one in general use in the Torres Straits (Haddon, 1912), while the old was the one used by the Eskimo and other northern peoples.

In Australia, harpoons were not employed by the tribes on the southern and most of the eastern coast of the Gulf of Carpentaria (McCarthy, 1957). McConnell (1953), who worked in this area, states that multi-pronged spears were used. The absence of harpoons in this locality is strange, especially as they do occur on the Western coast of the Gulf (Tindale, 1925), and on the Batavia and Pennefather Rivers on the northern part of the eastern coast of the Gulf of Carpentaria (Roth, 1904). Here the head consisted of a hardwood shaft, about 12 inches long, to which a wallaby or kangaroo-bone barb was lashed in such a manner, that it would also form the piercing point. This method of barbing is well known, and was used in many of the single barbed spears. Roth (1904) claimed that the bone barb occurred only in this locality. In later years, however, Thomson (1934) found it also at Princess Charlotte Bay.

Travelling north from the Batavia River, Cape York is reached. Macgillivray (1852), who supplies the information for the locality, states that " about Cape York and Endeavour Strait " the harpoon used " consists of a slender peg of bone, 4 inches long, barbed all round, and loosely slipped into the heavy, rounded, and flattened head of a pole, 15 or 16 feet in length ". This type of head is similar to the wooden one described by Haddon from the Torres Straits. Haddon further stated that the head brought back by Macgillivray, now in the British Museum, is of a pale brown, close grained wood, and not of bone, thus conforming with the wooden heads collected by him on the Islands.

Rounding the Cape and proceeding southwards, localities from which harpoon heads were collected are: Lloyd and Princess Charlotte Bays (Thomson, 1934), Barrow Point and Flinders Island (Hale and Tindale, 1933), Cape Bedford (Roth, 1904), Endeavour River (Cook, 1773), and Bloomfield River (Roth, 1904). In all these localities harpoon heads are of the same type as those obtained from the Pennefather and Batavia Rivers, with the exception that the single barb is made of wood instead of bone. At the Flinders Islands, and the Endeavour and Bloomfield Rivers, Roth also collected three-pronged heads, each fitted with a single wooden barb. These were fashioned after the style of the multi-pronged fishing spears. Information is lacking from points further south, until Whitsunday Passage is reached. Roth also stated that from here south to the Keppel Islands, as well as the single barbed type, natives used heads with two barbs, their position on the head being " bilateral and opposite ". South from the Keppels the New South Wales border is reached, and the multi-pronged spear comes into its own.

Upon placing the different types of harpoon heads encountered in Queensland on a map, a certain distribution pattern is visible. Beginning from the extreme north, and working south the following are noted:

(1) The Torres Strait type. A. At Cape York and Vicinity.

(2) The Single Barb. B. As far south as Bloomfield River on the East, and the Pennefather River on the West Coasts of Cape York Peninsula.

(3) The Multi-pronged Head. C. At the Flinders Group and at the Endeavour and Bloomfield Rivers.

(4) The Double Barb. D. Between Whitsunday Passage and Keppel Islands.

When this pattern is compared to the distribution of spears (Davidson, 1934) or fish hooks (Massola, 1956), the sequence is clear.

The several types of harpoons, spears, and fish hooks, arrived in Queensland from New Guinea, via the Torres Strait Islands. The first were probably the solid multi-barbed heads, which, however, have not been historically recorded for Queensland, but are still in use in Arnhem Land. The oldest of the existing types are presumably the ones now found furthest south. In the case of the harpoon, these are the double-barbed and the multi-pronged heads. These conform with the multi-barbed spear, with the barbs cut out of the solid, and the simple shell fish hook.

It is noteworthy that neither the double-barbed, nor the multi-pronged heads had the barbs cut out of the solid like the spear. This peculiarity shows a blending of two traditions, the ancient, original harpoon heads having, no doubt, solid barbs, but later giving place to the newer, lashed-on technique. The multi-pronged head is a variant of the double-barbed head and was, no doubt, copied from the fishing spear.

Following the double-barbed and the multi-pronged heads in time sequence came the harpoon head with the single bone or wooden barb lashed on. This conforms with the similarly barbed spear, and the composite fish hook with the bone or wooden barb lashed on to the wooden shank. It is interesting to see the single barbed heads occurring in the same localities as double-barbed and multi-pronged heads, as this shows infiltration of the newer ideas and the lingering of the old.

Finally, the Torres Strait type of harpoon head arrived. It had just made its appearance in the extreme north, and so had the bow and arrow, and the "bent pin" fish hook, when the introduction of wire and iron by Europeans and others, and the destruction of native culture, prevented their further spreading.

In later years Queensland natives used harpoon heads made of iron with the barbs cut out of the solid, or single or multi-pronged unbarbed wire heads. The distribution of these types does not follow a pattern, but they occur at random, no doubt dictated by availability of materials and by European introduction of natives from distant localities. The study of this acculturation does not come within the scope of this paper.

References.

Cook, Capt. J., 1773.—In Hawkesworth's " An Account of Voyages ". London III., p. 232.

Davidson, D. S., 1934.—" Australian Spear-Traits and their Distribution ". *Journal of the Polynesian Society.* XLIII., pp. 41–72 and 143–162.

Haddon, A. C., 1912.—" Reports of the Cambridge Authropological Expedition to Torres Straits ". IV., pp. 166–171 and plate XXIII.

Hale, H. H., and Tindale, N. B., 1933.—" Aborigines of Princess Charlotte Bay, North Queensland " *Rec. S. Aust. Mus.* V. No. 1, p. 106.

Kidder, J. E., 1959.—" Japan before Buddhism ". London.

King, Capt. P. P., 1827.—" Narrative of a Survey of the Intertropical and Western Coasts of Australia ". London, p. 245.

Macgillivray, J., 1852.—" Narrative of the Voyage of H.M.S. Rattlesnake ". London, II., p. 24.

McCarthy, F. D., 1957.—" Australian Aborigines: Their Life and Culture ". Melbourne, p. 57 and plate 41.

McConnell, Ursual H., 1953.—" Native Arts and Industries on the Archer, Kendall and Holroyd Rivers, Cape York Peninsula, North Queensland ". *Rec. S. Aust. Mus.* XI., pp. 1–42.

Massola, A., 1956.—" Australian Fish Hooks and their Distribution ". *Mem. Nat. Mus. Vict.* No. 22, Part 1, pp. 1–16.

Moseley, H. N., 1879.—" Notes by a Naturalist on the Challenger ". London, p. 361.

Roth, W. E., 1904.—" Domestic Implements, Arts and Manufactures ". *North Queensland Ethnography Bulletin* No. 7, pp. 31–33.

Thomson, D. F., 1934.—" The Dugong Hunters of Cape York ". *J. R. Anthrop. Inst.* LXIV., pp. 237–262.

Tindale, N. B., 1925.—" Natives of Groote Eylandt and of the West Coast of the Gulf of Carpentaria ". *Rec. S. Aust. Mus.* III., pp. 78–79.

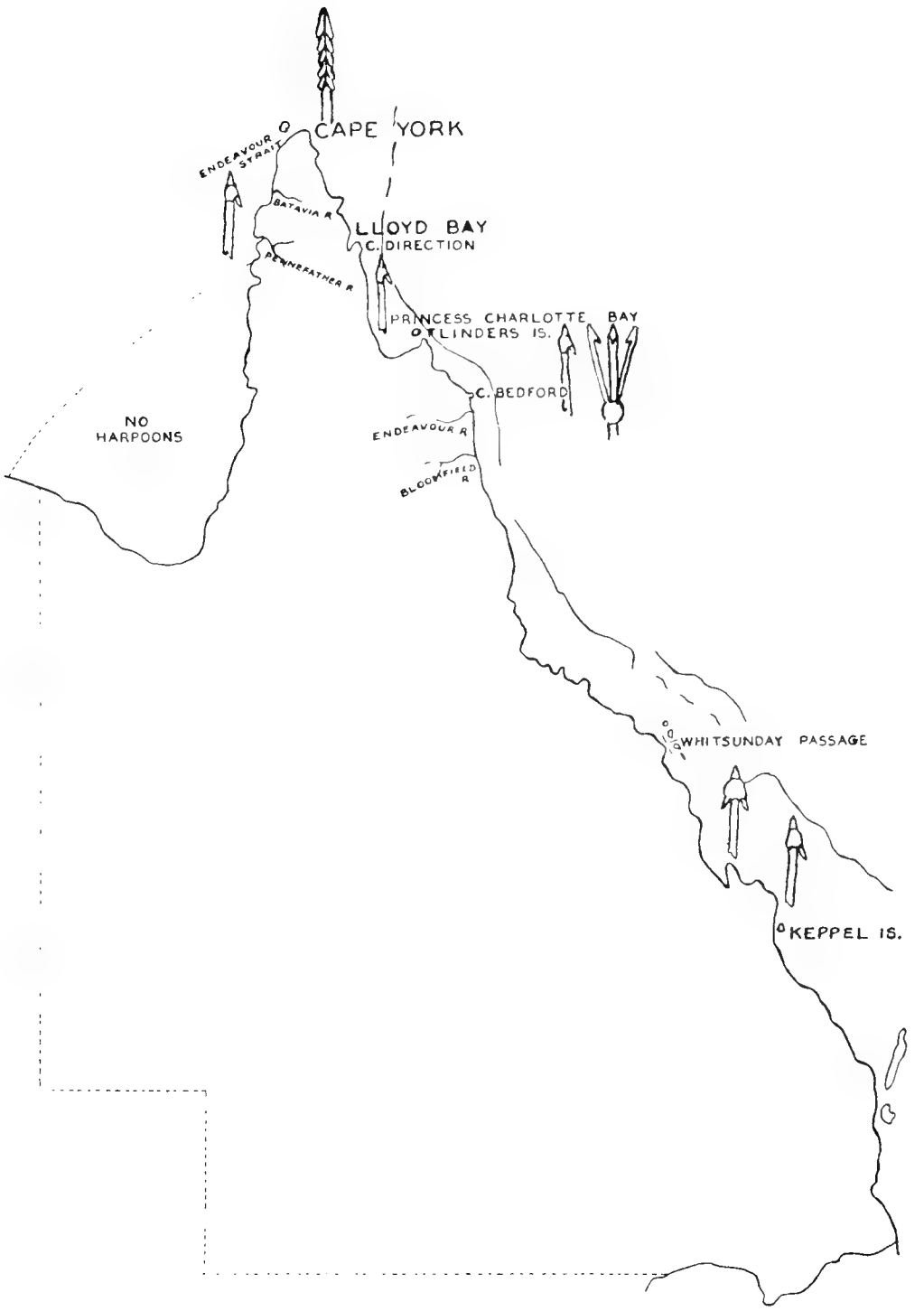


Fig. 1. Recorded Distribution of Queensland Harpoons.

A. The Torres Strait type.

B. The Single Barb type.

C. The Multi-pronged head.

D. The Double Barb type.

A NEW SPECIES OF TUDICULA FROM NORTH AUSTRALIA.

J. Hope Macpherson, Curator of Molluscs, National Museum of Victoria.

Tudicula (Tudicula) kurtzi sp. nov.

Adult shell approximately 60 mm. in length, white, spinose with a long anterior syphonal canal. Whorls rounded seven to eight including smooth, mammillate protoconch of 1½ whorls; the first two post nuclear whorls are sculptured with radial growth lines crossed by nodulose encircling ribs giving a cancellate appearance. The nodules of the upper encircling rib elongate into spines at about the third whorl and become progressively longer as the rib is followed down the whorls. The body whorl has ten shoulder spines. The number of the additional ribs on each whorl increases as the whorls enlarge until there are eight to nine on the body whorl and they become spinose but the spines are short (2½ to 3 mm. long) and set close together. The anterior canal also bears long encircling spines the size of which decrease towards the tapering anterior end of the canal.

Mouth elongate oval constricted and continuous with anterior canal. Outer lip not expanded and with the interior showing ribs which correspond to the lines of fine spines on the exterior.

Parietal shield well developed and free from the body whorl giving the aperture a tube-like appearance. Columella with three small distinct plaits towards the anterior end followed posteriorly by two or three indistinct ridges.

MEASUREMENTS.

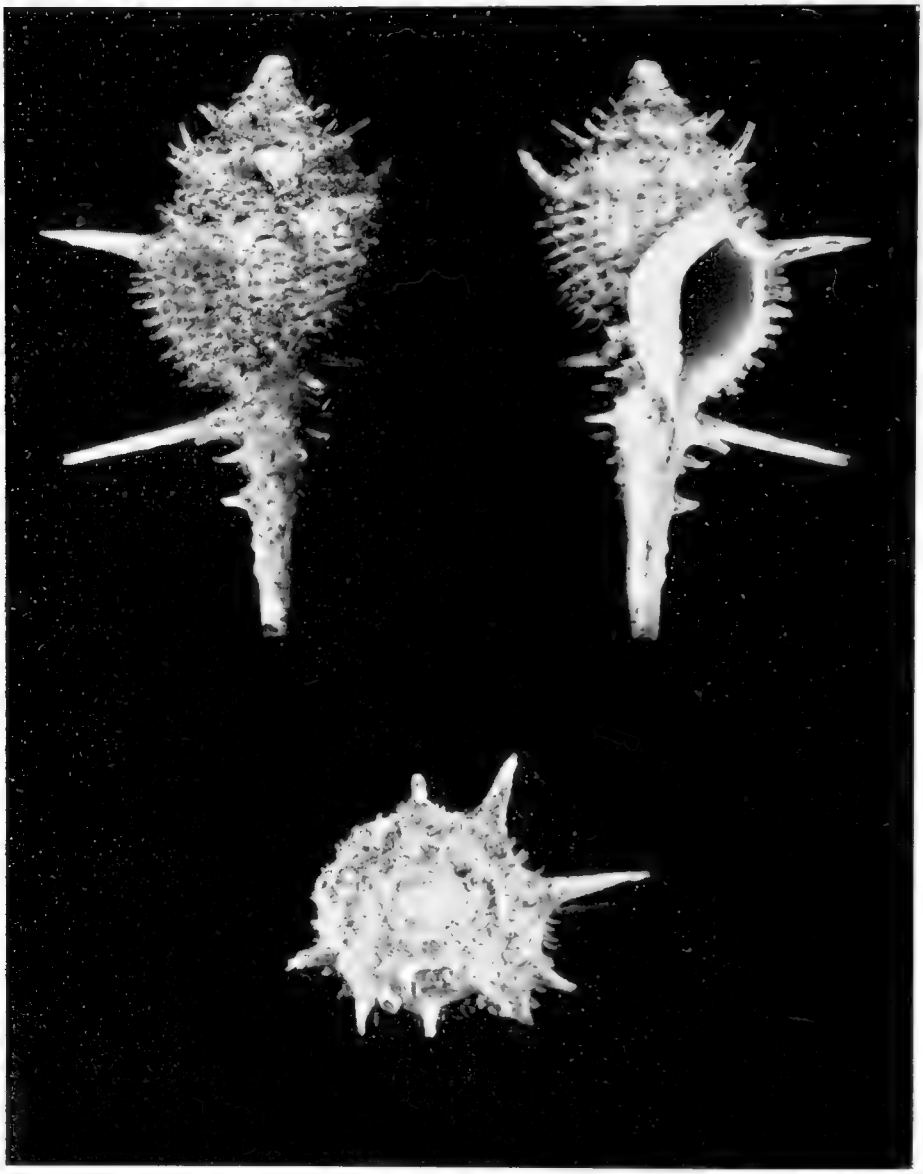
Holotype.—57 mm. long; 26 mms. wide.
Paratype.—63 mm. long; 32 mms. wide.

SPECIMENS EXAMINED. Holotype National Museum No. F 23320. Paratype C. F. Kurtze Collection; locality deep water Shoal Bay, Darwin, N. Territory.

REMARKS. These specimens were obtained by Mr. C. F. Kurtze of Portland during a collecting trip to Darwin and sent to the Museum for identification. Unfortunately, although fresh specimens, neither had an operculum and Mr. Kurtze has not been able to obtain further material.

It is close to *T. armigera* A. Adams but differs from that species in its lack of colour, more rounded whorls, more closely set and evenly spaced secondary ribs and spines.

339/63.—14



Tudicula (*Tudicula*) *kurtzi* sp. nov.

NEW GENERA OF TERTIARY ECHINOIDS FROM VICTORIA, AUSTRALIA.

H. Barraclough Fell, Victoria University of Wellington, New Zealand.

Introduction.

Through the courtesy of the National Museum of Victoria the following material was made available for study and for comparison with Tertiary echinoids from New Zealand. It proved to represent an undescribed genus of Temnopleuridae from the Batesfordian stage, and an undescribed genus of Brissidae from the lower Aldinga beds. The type specimens are in the National Museum of Victoria. I am grateful to Mr. M. D. King for the photographs in Plates 1 and 2, to Dr. J. Marwick for information on age correlation, and to Mr. Edmund D. Gill for his many kindnesses in connection with these and related studies.

Order TEMNOPLEUROIDA.

Family TEMNOPLEURIDAE.

IRENECHINUS gen. nov.

Small forms of hemispherical shape. Pore-pairs in a vertical series. Primary tubercles, and many of the larger secondary tubercles, crenulate; all tubercles imperforate. Radiating series of secondary tubercles surround the primaries, tending to form zig-zag series on the interambulacral mid-zone. Apical system regularly dicyclic. Gill-slits small, indistinct. Spines unknown.

Type species: *I. hentyi.*

Irenechinus hentyi sp. nov.

Plate 1.

Height, 8·5 mm.; horizontal diameter, 15·0 mm.; peristome diameter, 5·0 mm. Apical system lost, but its regularly 10-lobed outline is preserved by the adjoining plates, indicating that it is dicyclic with all the oculars exsert.

Ambulacral plates 13 in each series, each carrying one primary and numerous secondary tubercles. Interambulacral plates 11 in each series, each carrying one primary and numerous secondary tubercles.

Ambulacral sculpture.—The pore-pairs are oblique, not on distinct depressed oval areas, but separated by transverse ridges of epistroma, one such ridge curving round the upper margin of each successive pore-pair. The ambulacral mid-zone is traversed by a double zig-zag series of secondary tubercles, about six tubercles in each oblique row, all more or less fused into a continuous ridge. The primary tubercles, which are imperforate and almost spherical, form vertical series on either side of the amb, immediately adjacent to the poriferous zone. They form a well-marked vertical row in conjunction with secondary tubercles, of which two or more lie between each successive primary; they do not form a distinct vertical ridge. Very little test is visible between the crowded secondaries, but what can be seen is smooth.

Interambulacral sculpture.—Each primary tubercle is surrounded by a radiating system of about 10 ridges, usually arranged so that there are two vertical ridges above (communicating with the next primary), two similar ones below (communicating with the adjacent primary), and three on either side (each communicating with a ridge which lies between the adjacent pore-pairs of the ambulacra). The arrangement described is that on the ambital plates, but it persists with little alteration almost to the apex. The ridges are made up of secondary tubercles, more or less fused together. The ridges which lie on either side of the primaries tend to form a double zig-zag row, and this is especially apparent in the interambulacral mid-zone, and is accentuated if there happen to be four transverse ridges to a primary instead of three. The general effect is that of short strings of pearls, sewn onto plain material, to form the pattern described.

Holotype: Specimen P16409 in the collection of the National Museum of Victoria.

Locality: Batesfordian *Lepidocyclina* limestone, below A. Henty's house "The Caves", on Grange Burn, west of Hamilton, Victoria, collected and presented by E. Henty Jr., April 1955. The formation is the Bochara Limestone.

Horizon: Lower Miocene, about equivalent to the New Zealand Lower Southland stage (J. Marwick).

Remarks: *Irenechinus* is related to *Brochopleurus,* with which it shares the radiating arrangement of ridges formed by numerous secondary tubercles around the primary tubercles, and the vertical series of pore-pairs. It differs from *Brochopleurus* in having distinctly crenulate tubercles, and a tendency to zig-zag

series of tubercles in the interambs. *Irenechinus* resembles *Paradoxechinus* in having such zig-zag series, though they are more distinct in *Paradoxechinus,* but differs from that genus in having scattered secondary tubercles, and in the crenulation of the tubercles. *Irenechinus* resembles both *Brochopleurus* and *Paradoxechinus* in having a regularly dicylic apical system. indistinct gill-cuts and imperforate tubercles.

Order SPATANGOIDA.

Family BRISSIDAE.

GILLECHINUS gen. nov.

Test of ovoid outline, convex above and below, of moderate size; apex subcentral, slightly anterior; peristome crescentic, anterior; periproct vertically ovate, placed on the vertically truncate posterior margin of the text; vertex posterior. A peripetalous fasciole, not cutting the petals, and a subanal fasciole, transversely reniform; no anal fascioles. Apical system ethmolytic, four genital pores. Frontal ambulacrum very shallow, frontal notch very faint. Paired petals somewhat depressed, extending more than midway to the ambitus. Interambs all somewhat inflated above, the paired interambs carrying a conspicuous group of primary tubercles on each posterior column of plates, the primary tubercles confined within the peripetalous fasciole; no primary tubercles on the posterior interamb. Plastron completely tuberculated, the tubercles arranged in a fan-like group of lines radiating from the posterior keel of the plastron.

Type species: *G. cudmorei.*

Gillechinus cudmorei sp. nov.

Plates 2 and 3.

Dimensions of holotype: Height, 30 mm.; length, 55 mm.; breadth 51 mm.

Ambulacra: the petals are well developed, only the adapical 4-6 pore-pairs rudimentary, both series equally developed in each petal, the petals scarcely closing distally. There are twenty fully-developed (plus several rudimentary adapical) pore-pairs in each series of the anterior petals, and about nineteen fully-developed (plus several rudimentary adapical) pore-pairs in each series of the posterior petals. The pores are feebly conjugate, mainly because the distal margin of each amb-plate is slightly depressed. There is no ridge between successive pore-pairs, instead a broad, flattened rectangular area on which several small

miliary tubercles occur, in an irregular transverse series five to seven, with occasionally a secondary tubercle among them. The pores of the inner and outer series of both anterior and posterior petals are sub-equal. The peripetalous fasciole passes just distal to the ends of the petals; it is narrow, and rather indistinct over parts of its course, but reaches to the anterior ambulacrum.

Interambulacra: Fine secondary tubercles are scattered rather evenly over the whole aboral surface, but the enlarged primary tubercles of the paired interambs are so conspicuous as to make the rest of the surface appear relatively naked. There are about twenty primaries in the anterior interamb, all restricted to the posterior column of plates within the peripetalous fasciole; in the same relative position in the posterior paired interamb occur some 22 primaries. The primaries are arranged in several series parallel to the transverse axes of the plates which bear them, and in each row the anterior members are smaller than the posterior.

Apical system and subanal plastron and fasciole: as in the generic diagnosis.

Peristome, periproct and plastron all broken in holotype (see however paratypes mentioned below). Spines unknown.

Holotype: Specimen P16022 in the collection of the National Museum of Victoria.

Locality: Lower beds, Aldinga, South Australia, coll. F. A. Cudmore.

Horizon: About upper Eocene (Glaessner).

Paratypes: Two specimens from the type locality. One of these (P16023) is a complete test, but has lost the characteristic sculpture of the upper surface. It shows however that the periproct is vertically ovate, placed in a slightly depressed area on the vertically truncate posterior margin of the test, and that no trace of anal fascioles occurs (the holotype is well-enough preserved in this region to prove the absence of anal fascioles); and that the peristome is transversely crescentic, the plastron being fully tuberculated. The paratype P16023 is illustrated in Plate 3; it measures, length 48 mm.; breadth 46 mm., and height at vertex 26 mm. A third specimen (P16021) is incomplete, but suffices to show that the species reached a larger size than the holotype, perhaps half as large again (though no precise measurements can be given).

Remarks: In Mortensen's (1951) *Monograph,* this material has no place in the key to genera, since only *Eupatagus* matches the genus; but this latter differs from *Eupatagus* in several respects, notably in the arrangement of the primary tubercles, which are like those of *Plagiobrissus,* and in the indistinct closure of the petals. The whole aspect of *Gillechinus* matches that of *Plagiobrissus,* not *Eupatagus,* yet it differs markedly from *Plagiobrissus* in the complete absence of the anal fascioles, in the conspicuous breadth of the posterior ambs on the oral side, and in the bilobed reniform subanal plastron (which is shield-shaped, and not bilobed, in *Plagiobrissus*). *Gillechinus* is unknown outside Australia, though some superficially similar Tertiary species occur in New Zealand; these latter species, however, have an internal fasciole, and cannot be referred to the Brissidae.

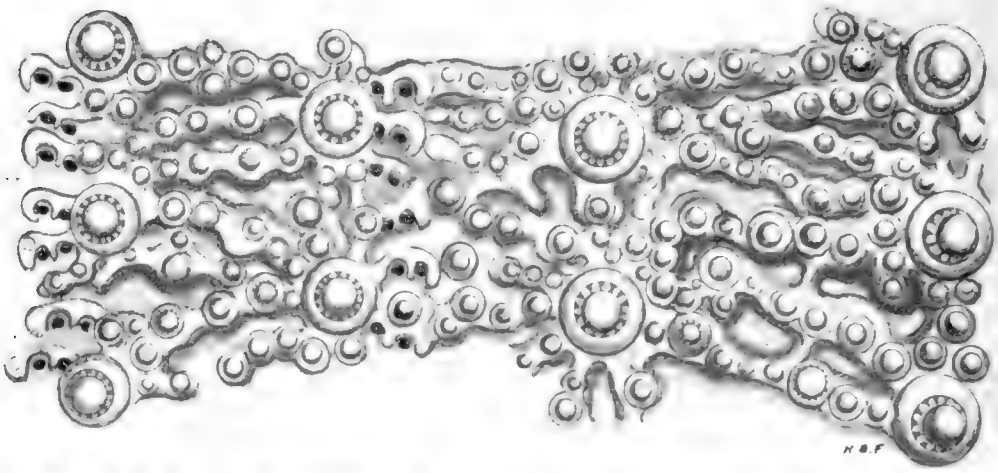
Reference.

Mortensen, Th. 1951.—A Monograph of the Echinoidea, 5 (2), Copenhagen.

Captions for Plates 1 and 2.

Plate 1.—Above, *Irenechinus hentyi* n.g., n.sp. holotype P16409, detail of amb, on left and of interamb on right, near the ambitus, X 12. Below, *Gillechinus cudmorei* n.g., n.sp., holotype P16022, in aboral aspect, X 2.
Photo M. D. King.

Plate 2.—*Gillechinus cudmorei* n.g., n.sp.,: Above, paratype P16023, in aboral aspect, X 2. Below, holotype P16022, in lateral aspect, X 2.
Photo M. D. King.



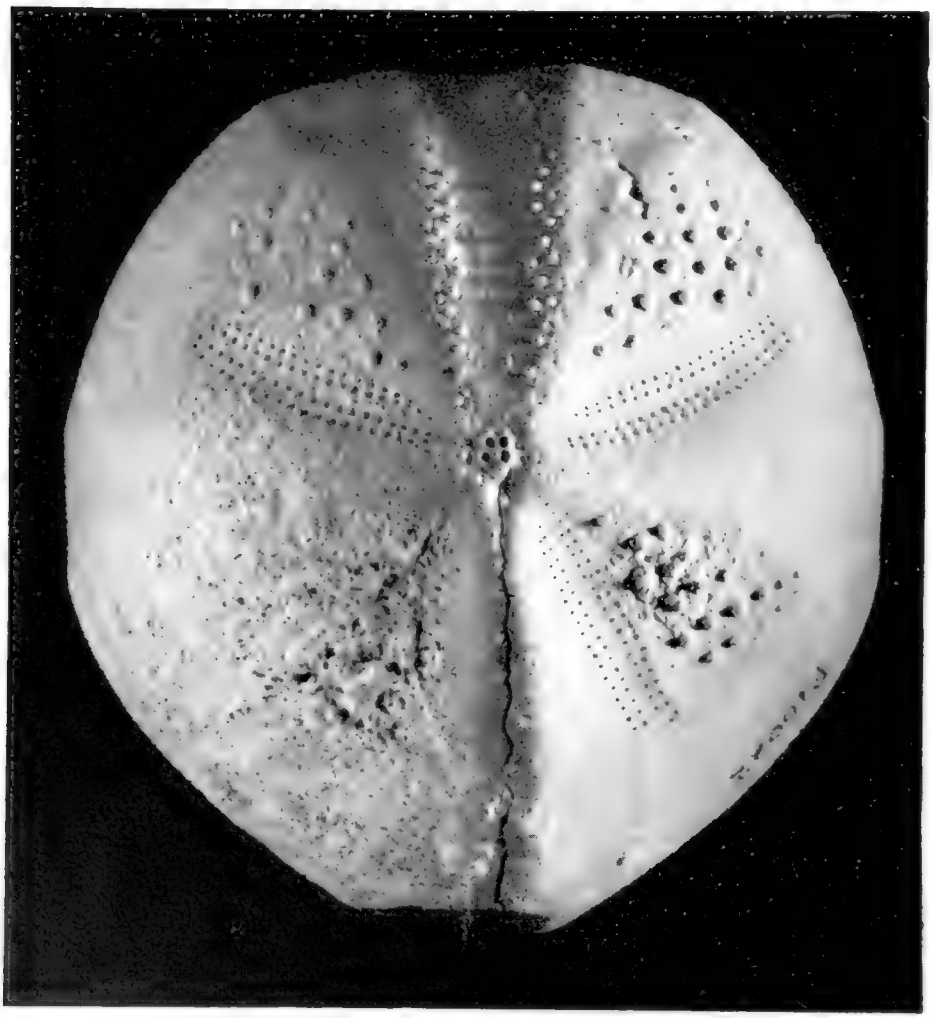


PLATE 1.

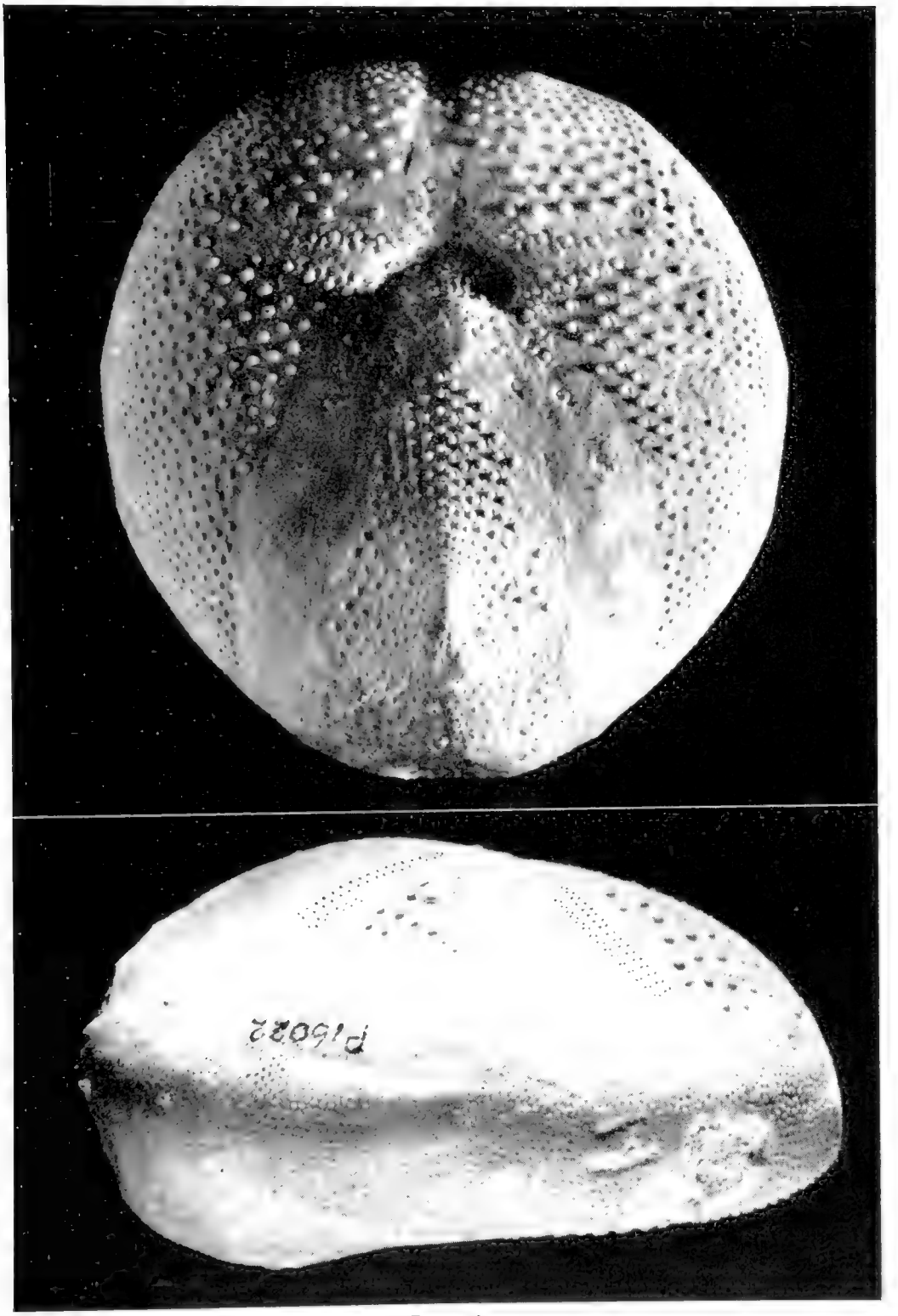


PLATE 2.

STUDIES OF THE GENUS *KATELYSIA* RÖMER 1857 (MOLLUSCA, LAMELLIBRANCHIATA).

By Barbara J. Nielsen.

Introduction.

There has been confusion as to the validity of the species included in the genus *Katelysia* Römer 1857, and this suggested the necessity for an assessment of its representatives in Victoria. This was followed by detailed studies of two particular species *Katelysia scalarina* Lamarck 1818 and *Katelysia rhytiphora* Lamy 1935 to ascertain their validity as biological or ' natural ' species as against specific separation based on shell morphology alone. This includes the anatomy of the animals, statistical analyses of shell measurements and an investigation of breeding cycles. The third species *K. peronii* Lamarck 1818, is omitted because of insufficient material.

Synonymy.

Although Eduard Römer established the genus *Katelysia* for a group of *Venus* like lamellibranchs from southern Australia (genotype *K. scalarina* Lamarck 1818) in 1857 the name does not appear again in the literature until 1914 when Jukes-Brown used it in his revision of the family Veneridae. Later Lamy (1935, 1937) revised the Lamarkian species consigned to it. Unfortunately, Lamy's work was by-passed by Australian conchologists, most basing their check-lists on Pritchard's and Gatliff's condensation (1903) of nine Lamarckian species of Venus into three species, *Chione strigosa, C. scalarina* and *C. peronii. Katelysia* first came into general usage in 1938, when Cotton and Godfrey revived the name and recorded three species from South Australia.

Because of the numerous writers it is easiest to consider first the species listed in the four latest works of Kershaw (1955), Macpherson and Chapple (1951), Allan (1950) and Cotton and Godfrey (1938). As Kershaw's listing follows that of Cotton and Godfrey no distinction will be made between these two groupings.

Macpherson and Chapple used the grouping of Pritchard and Gatliff (1903), substituting Römer's generic name *Katelysia* for that of *Chione*. Allan in 1950 not only extended the scope of the genus to include two extra species and also included *K. enigma* Iredale 1936, which she suggested is similar to *K. strigosa* Lamarck of Victoria and *K. corrugata* Lamarck of South Australia.

The two extra species listed by Allan are *K. gallinula* Lamarck 1818 and *K. lagopus* Lamarck 1818. The former species has already been placed in the genus *Tawera* by Marwick in 1927. Both species are clearly closely related and differ considerably from members of the genus *Katelysia*.

Unfortunately Allan does not give any reason for her inclusion of these two species in *Katelysia* but as they both have features characteristic of the genus *Tawera* it is preferable to leave them in this genus.

Katelysia enigma Iredale 1936 was first described from one rather old and worn valve from Port Jackson, possibly of sub-recent origin. The type has been examined by the writer and is considered to belong to the same species as *K. strigosa* (Macpherson and Chapple 1951) (= *K. corrugata* (Cotton and Godfrey 1938)). The species does not seem to be living in great numbers in Port Jackson although sub-recent specimens are relatively common.

The specific name *K. corrugata* Lamarck 1818 used by Cotton and Godfrey (1938) is pre-occupied. It was first given to a *Circe* by *Chemnitz* (1784) and later to a *Tapes* by Gmelin (1791). Chemnitz is not accepted by the International Commission of Zoological Nomenclature (Schenk and McMasters 1950) but *Tapes corrugata* Gmelin is still valid. The latter is a Mediterranean species.

Sowerby 1855 illustrated a shell which he called *Venus strigosa* Lamarck and which Pritchard and Gatliff (1903) and later authors have considered to be a synonym of *corrugata* Lamarck and thus available to replace it.

Lamy pointed out that the species illustrated by Sowerby as *Venus strigosa* Lamarck is not the same as that described by Lamarck (1818). The Lamarckian species does not possess the radial striations shown in Sowerby's figure and these are not present on the type in the Paris Museum, which is similar to *Venus aphrodina* and *V. scalarina*. Sowerby comments after his description of *V. strigosa* that Lamarck does not mention these radial striations and suggests he did not notice them. However, as Sowerby's *V. strigosa* conforms with Lamarck's description of *V. corrugata* it is hardly likely that Lamarck did not notice this prominent feature when describing *V. strigosa*.

Thus the species described by Lamarck as *Venus corrugata* was left without a name. Lamy (1935) proposed the name *Katelysia rhytiphora* for this species and Macpherson (1958) used Lamy's *K. rhytiphora* for the first time in Australian literature.

Jukes–Brown (1914) included *Marcia* (*Katelysia*) *regularis* Deshayes and *Marcia* (*Katelysia*) *decussatus* Deshayes in the same genus as *K. scalarina et al.* However they appear to be closer to *Hemitapes* Römer. Römer gives *Venus conularis* as the type of the genus *Hemitapes* while Lamy (1937) includes this species in *Katelysia*. From Delessert's illustration (1841) it would appear that the type is an old discoloured shell and therefore its true position is uncertain. This immediately casts doubt on the validity of Römer's genus *Hemitapes* but this is beyond the scope of the present paper.

It is proposed therefore, to accept Lamy's species *K. rhytiphora* and the following two Lamarckian species, *K. scalarina* and *K. peronii* in the genus *Katelysia*. Fortunately there is no doubt about the position of *K. scalarina* Lamarck, specimens having been compared with the type at the Musee d'histoire Naturelle, Geneva by courtesy of Dr. E. Binder.

The type of *K. peronii* was not available at Geneva and is presumably in Paris since Lamy (1937) mentions five species which according to Lamarck's label were collected in Australia by Peron and Lesueur (1803). *K. peronii* has been confused with *K. rhytiphora* and was also given as a variety of *K. scalarina* by May (1921).

The remaining Lamarckian species which have been included in the genus can either be regarded as synonyms of the three above mentioned species or rejected from the genus.

The type of *Venus tristis* Lamarck 1818 is at Geneva. Photographs by Dr. Binder show that the specimen does not resemble *K.scalarina* as suggested by Binder (personal communication) nor does it possess the radial striations of *K. rhytiphora* and *K. peronii*. Also the hinge line does not resemble that of the three above-mentioned species, the central cardinal tooth on the left valve being deeply bifurcated. In *Katelysia* it is only slightly bifid.

The supposed type of *V. elegantina* Lamarck 1818 resembles *V. tristis* very closely and it is suggested that these two belong to the same species. Their exact generic position is uncertain. Römer places them both in *Hemitapes*.

Katelysia peronii Lamarck 1818.

PLATE II., FIGS. 1–3.

Venus peroni Lamarck 1818 (p. 606, No. 81); Handle 1842 (p. 126); Menke 1843 (p. 44, No. 255); Philippi 1849 (vol. 3, pl. 8, fig. 8, 9).

Venus aphrodinoides Lamarck 1818 (p. 606, No. 82); Reeve 1864 (pl. 17, sp. 73).

Venus flamiculata Lamarck 1818 (p. 605).

Chione peronii Deshayes 1853 (p. 146, No. 81); Pritchard and Gatliff 1903 (p. 127, p. 94, pl. 15, fig. 9–10).

Chione aphrodinoides Deshayes (p. 148, No. 85).

Tapes victoriae Tension Woods 1878 (p. 55).

Marcia (Katelysia) aphrodinoides Lamy 1937 (p. 76).

Katelysia peronii Cotton and Godfrey 1938 (p. 243, Fig. 271); Allan 1950 (p. 331, pl. 39, Fig. 2); Macpherson and Chapple 1951 (p. 152); Kershaw, 1955 (p. 288, No. 189); Macpherson 1958 (p. 54, pl. 50 Fig. 7).

Shell ovate, tumid, more rounded than the other two species; sculptured with flat, slightly irregular ridges, crossed by faint radial costae. Shell colour cream with faint to irregular black angular marking not very clear. Inside the shell is cream to yellow with purplish markings.

Katelysia scalarina (Lamarck, 1818).

PLATE I., FIGS. 1–3.

Venus scalarina Lamarck 1818 (p. 599, No. 54); Delessert 1841 (pl. 10, fig. 12, a, b, c,); Hanley 1842, 1856 (p. 123, p. 358, pl. 16, fig. 4); Menke 1843 (p. 44, No. 254); Sowerby 1849–1855 (p. 736, No. 96, pl. 162, fig. 215–220; Reeve 1864 (pl. 20, sp. 96).

Venus aphrodina Lamarck 1818 (p. 605, No. 82); Delessert 1841 (pl. 11, fig. 1, a, b, c); Reeve 1864 (pl. 17, sp. 76).

Venus strigosa Lamarck 1818 (p. 605, No. 79).

Venus humphreyi Donovan 1834 (p. 16, pl. 78, fig. 2).

Chione scalarina Deshayes 1853 (p. 148, No. 86); Tate and May 1901 (p. 427); Pritchard and Gatliff 1903 (p. 127, p. 94, pl. 15, Fig. 7, 8).

Chione aphrodina Deshayes 1853 (p. 147, No. 84).

Marcia (Katelysia) scalarina Jukes-Brown 1914 (p. 88); Lamy 1937 (p. 75).

Marcia scalarina Hedley 1917 (p. M.24, No. 248); May 1921–1923 (p. 24, No. 178, pl. 10, Fig. 15).

Katelysia scalarina Cotton and Godfrey 1938 (p. 242, 243, Fig. 270); Allan 1950 (p. 331, 326, Fig. 77, No. 6); Macpherson and Chapple 1951 (p. 152); Kershaw 1955 (p. 228, No. 188), Macpherson 1958 (p. 14, pl. 10, Fig. 15).

Shell:

Equivalve, inequilateral, anterior dorsal margin less than half the length of the posterior dorsal margin. The angle at the umbos made by the two dorsal margins averages 114 deg. The ventral margin is smooth, flatly convex; the posterior and anterior margins are rounded. The hinge line is typical of the family Veneridae. There are three cardinal teeth on each valve—$\frac{\text{L } 101010}{\text{R } 010101}$ and no lateral teeth. The central cardinal tooth of each valve is bifid and does not extend to the ventral edge of the hinge plate. The angle between the posterior cardinal and

the central cardinal, in both valves, is more acute than that between the anterior cardinal and the central cardinal. All teeth are straight. The ligament is external, typical of the family. The lunule is narrow, lanceolate, well defined and the same colour as the rest of the shell. The escutcheon is long and smooth and prominent. Shell sculpture consists of concentric ridges parallel to the ventral margin, turned over except at the posterior end where they are produced into thin straight lamellae. There are no radial costae. Internally the adductor muscle scars and the pallial line are not very conspicuous. The posterior retractor muscle scar is sometimes partially separate from that of the posterior adductor muscle and easily distinguished in the shell. The anterior adductor muscle scar is elongate dorso-ventrally. Colouration is fairly consistent. The outside is very pale cream with faint grey black angular markings covering most of the shell. The inside is white with faint purple markings about the hinge and on the posterior margin. Some specimens from Port Arthur, Tasmania, were a uniform deep purple inside. It is suggested that this colouration is due to environmental conditions since examples of all three species from this locality show the same colouration.

Estuarine specimens from Lakes Entrance, Victoria (N.M. F1633) and the Tamar Estuary, Northern Tasmania, are distinguished by a thicker shell with broader, rounder, concentric ridges with no thin lamellae at the posterior end and the cardinal teeth are more deeply bifid. The outside of the shell is usually cream, the inside varying from pure white in Victorian forms to a very deep purple in some Tasmania forms.

Another variation is found in specimens from American River, Kangaroo Island. The shell resembles the type in having very similar sculpture and colouration but differs in outline, the anterior-posterior direction being strongly produced so that the shell forms a narrow ellipse.

It is possible that this variant is a separate race of the species but the differences are not sufficient to warrant the erection of a sub-species. However, a variety from south Western Australia is considered by the writer to be sufficiently distinct to be placed in a sub-species.

Katelysia scalarina sub-species polita sp. n.

PLATE I., FIGS. 4–6.

Shell similar to *Katelysia scalarina* s.s. in general outline and hinge area. " Concentric ridges less well defined than in *scalarina* senso stricto and not turned over to form sharp lamellae. Most shells show inconformity in sculpture indicating periodic breaks in the growth rate. Surface highly polished ".

The Holotype is in the National Museum of Victoria, No. F23499 and six paratypes No. F23500.

This sub-species is restricted to south-western Australia having been taken at Emu Point, Albany; Blackwood River, Augusta; Jervis Inlet; Nornalup and Novabiti Inlet near Perth.

FIG.1-DISTRIBUTION OF K SCALARINA

Distribution.

The distribution of *K. Scalarina* is shown on the accompanying map (Fig. 1). Apart from the living population extending from southern New South Wales to south Western Australia and Tasmania there is an extensive sub-recent fauna in the Pleistocene marine deposits of south-eastern South Australia (Crocker and Cotton, 1946) and also in Western Australia particularly on Rottnest Island.

In the area south of Mount Gambier to the east of Kingston extending sixteen miles inland from the present coastline, Crocker and Cotton record only one species, *K. scalarina.* However, in a collection seen in the Geology School, Melbourne University (collected Mr. A. A. Baker) from a deposit five miles west of Lake St. Claire, all three species were present, *K. scalarina* and *K. rhytiphora* predominating. Specimens of *K. scalarina* were typical sandy beach forms similar to those found at present in South Australia and Victoria.

Ecology.

This species is usually found in quiet, sheltered sandy bays and occasionally in estuarine conditions. While it has been collected from many localities it was necessary for purposes of study to choose a locality close to Melbourne. A sheltered bay on the north side of Mornington Jetty was found to be the most suitable. Here a large population of *K. scalarina* live in fine to medium grained sand about two to four centimetres below the surface, between the tide marks. At high tide they are covered by 0·3 to 1 metre of water.

The bay is shallow and crossed by several sand banks with occasional patches of *Zostera.* At the southern end of the bay there are patches of shingle and rock associated with the breakwater and the jetty.

K. scalarina appears to be restricted to the area between the tides. They are not uniformly scattered throughout the area but live in groups of half a dozen or more. Occasionally, specimens of *K. rhytiphora* are found in these groups but most occur in deeper water beyond the *K. scalarina.*

The associated fauna is similar to that of most sandy beaches in Port Phillip. Apart from *K. scalarina,* the dominant bivalve, *Amphidesma angusta* is also common between the tides. *Nassarius pauperatus* is the dominant gastropod while *Zeacumantis cerithium* appears in great numbers at certain times, but at others not at all. Other species recorded are *Conuber conicum, Cominella lineolata, Philine angasi,* and *Bullaria botanica.*

A prominent member of this community is an unidentified sea anemone attached to the posterior portion of the *K. scalarina* when they are buried in the sand. This anemone has also been found in the same association at Rosebud. It occurs in great numbers and proved a convenient means of detecting *K. scalarina.* It has not been found attached to neighbouring rocks where another, larger anemone, *Oulactis muscosa,* is common. In Tasmania, at Ralph's Bay this small anemone has been found attached to *Aloidis flindersi.*

ANIMAL MORPHOLOGY.

Although most zoologists are familiar with the general structure of the lamellibranch animal a fairly detailed description is included here because the members of the family Veneridae have not been described in detail. Most detailed descriptions are of the more primitive or more unusual families such as the Nuculidae and Mytilidae.

Mantle:

The animal is covered by the mantle, the two edges of which are completely free along the anterior and ventral margins. Posteriorly they join and are produced to form two siphons. Apart from the portion of the mantle ventral to the pallial line, the greater part consists of thin clear tissue containing some blood vessels but no extensions of the gonads as in *Mytilus.*

The mantle is attached to the shell valves along the pallial line by bands of muscle extending from the mantle edge for about 6 mm. to the pallial line. These bands of muscle are fine, closely set together and bifurcate several times before reaching the mantle edge.

The mantle edge is divided into three lobes (Yonge, 1948), an inner muscular lobe, a middle lobe which is thinner and less muscular, and an outer lobe which is thin and closely applied to the inside of the shell. The inner lobe is produced posteriorly to form the siphons and just anterior to the siphons divides into numerous finger-like processes.

The siphons are short and separate for most of their length. Their colour is white. On the outside they are covered for about half their length by scattered spots of black pigment. Inside, both siphons are lined with an epithelium, pigmented with bright yellow and varying amounts of black and bright orange.

The aperture of the exhalent siphon is encircled by a single row of small tentacles, the actual aperture being formed by a thin membrane capable of expansion during the expulsion of waste material. There are two rows of tentacles about the inhalent aperture; an outer one of small tentacles and an inner one of large tentacles, the small and large tentacles alternating with each other.

The internal openings of the siphons are wider than the external. The opening of the exhalent siphon is separated from that of the inhalent by a band of connective tissue which prevents the waste material contaminating the incoming current of water. Anteriorly and dorsally this connective tissue extends over the surface of the posterior adductor muscle covering the visceral ganglia and also supporting the nerves from the ganglia to the siphons.

Anteriorly the two mantle edges join near the ventral border of the anterior adductor muscle. Here the mantle is continuous with the connective tissue covering the posterior surface of the muscle and carrying the two nerves from the cerebral ganglia into the mantle edge.

The pericardial gland lies posterior to the umbos at the anterior end of the pericardial cavity. It is a reddish brown organ (White, 1928).

Gill Lamellae or Ctenidia:

The general form of the ctenidia is typical of the Veneracea. The axis extends from the region of the pericardial gland to the septum between the two internal openings of the siphons. The inner demibranch is also attached to the visceral mass along the dorsal side from the posterior end of the gill axis to the mouth. In *K. scalarina* this border of the inner demibranch is about 0·75 the length of the gill axis, while in *K. rhytiphora* it is aproximately equal to the length of the gill axis. This inner demibranch is much larger than the outer which has about half its surface area.

The ascending lamella of the outer demibranch has a super-axial extension (Ridewood, 1903) which covers the pericardial cavity and the kidney, in some animals being attached to the pericardium along its dorsal margin. The demibranches are strongly plicate.

Labial Palps:

The labial palps surround the mouth, there being two pairs—one dorsal, one ventral. Members of each pair are joined together by a strand of tissue. The surface of each palp is crossed by transverse ciliated ridges.

Kidneys:

The kidneys or renal organs are a pair of conspicuous brown triangular organs lying at the posterior end of the pericardial cavity, each covering a pedal retractor muscle.

Adductor Muscles:

The anterior adductor muscle is slightly smaller than the posterior. Both are composed of bundles of muscle fibres passing from one valve to the other and loosely held together by fine connective tissue. The bundles are composed of fine non-striated and striated muscle cells from 2 to 3 mm. long.

The Foot and Visceral Mass.

The foot and visceral mass are held in the shell by two pairs of muscles, the anterior and posterior pedal retractor muscles. The anterior pedal retractor muscles pierce the dorsal part of the mantle just posterior to the anterior adductor muscle and are attached to the shell slightly anterior of the anterior cardinal tooth below the hinge plate. The posterior pedal retractor muscles lie dorsal to and very close to the posterior adductor muscles. Usually on the shell the muscle scar of the posterior pedal retractor is so close to that of the posterior adductor that it is difficult to distinguish the two. However in some the two scars are partially separated.

The foot is best described as a hatchet shaped muscular bag, the ventral portion of which is composed mainly of muscles and blood vessels while the dorsal portion contains the gonads, alimentary canal and digestive glands. These are enclosed by a muscular wall which is composed of two sets of fibres diagonally crossing each other. One coat of fibres, the inner, arises from the anterior pedal retractor muscle and passes posteriorly to the ventral margin of the foot. The outer coat of fibres arises from the posterior retractor muscle and passes to the anterior ventral margin of the foot.

Internal Anatomy and Histology.

Alimentary Canal and Associated Organs:

The mouth opens on the anterior side of the visceral mass near the dorsal margin. It is compressed dorso-ventrally and opens into a narrow oesophagus which is about 3·5 mm. long. This is also compressed dorso-ventrally. It is lined with tall ciliated columnar epithelial cells resting on a thick basement membrane. Below this is connective tissue and muscle.

The oesophagus leads into the stomach, an irregularly shaped organ, 5·5 mm. long and 3 mm. high. The mid gut leaves the posterior end of the stomach on the ventral side, at 90 deg. to the long axis of the stomach.

The anterior portion of the stomach is covered completely by the three lobes of the digestive gland. This is a large pale green racemose gland 7 mm. by 5 mm. This gland is connected to the stomach by three wide ducts, one leaving on the left side and two on the right. The ducts leaving the stomach are broad thin-walled tubes. As they enter the gland they branch into several lobes and after further branching, end blindly as the digestive diverticulae. There appears to be a small caecum at the posterior end of the stomach between the openings of the right and left ducts separated from the opening of the right duct by a ridge. The gastric shield is on the posterior dorsal wall of the stomach and extends over the left side. Its presence was revealed in sections only.

The stomach is lined with a ciliated epithelium composed of tall narrow columnar epithelial cells. These cells have a prominent large, oval nucleus with a large nucleolus, most of the chromatin being concentrated about the periphery of the nucleus. The cilia are long and at their base there is a prominent row of basal granules. (Fig. 2.)

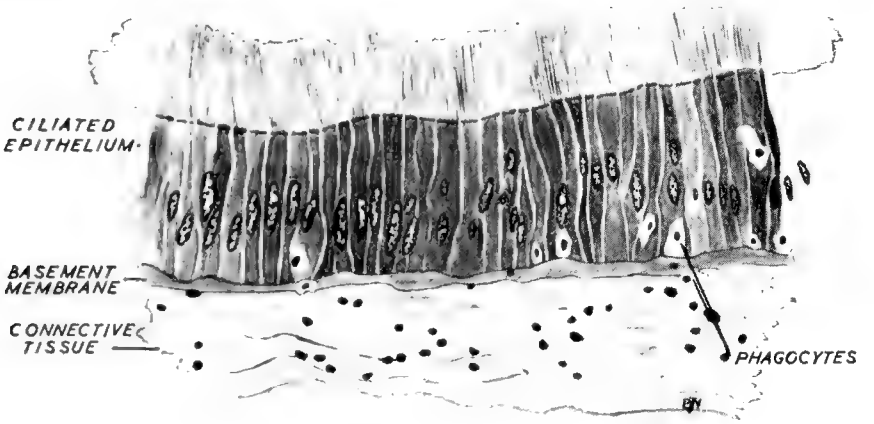


FIG. 2 - T.S. STOMACH WALL (*K. SCALARINA*) X 700

Beneath the gastric shield the cells are of the same histological type as the other epithelial cells although taller. It is doubtful whether cilia are present even though Yonge (1926) claims they are present in *Ostrea*.

In *K. scalarina* the cells beneath the shield, unlike those illustrated by Gutheil (1912, fig. 14, page 462) each have a prominent row of basal granules which are also seen in the adjacent cells not beneath the shield. Although Gutheil does not show the granules in his figure he mentions that there are various stages of degeneration in the epithelial cells. Yonge (1926) on the other hand shows both basal granules and cilia. According to Edmondson (1920) the cells beneath the gastric shield of *Mya arenaria* are not ciliated. Yonge (1926) found no mucus glands beneath the gastric shield although they were scattered through the rest of the stomach epithelium. As no mucus stains were used in this investigation the presence or absence of these cells has not been determined in *K. scalarina*.

The epithelium lining the larger ducts of the digestive gland is continuous with that of the stomach and is composed of similar cells. These cells are shorter and the cilia longer than those in the stomach. Phagocytes are numerous being scattered between the epithelial cells, in the basement membrane and the underlying circular muscles.

The ducts end in the digestive diverticulae which consist of bulbous blind tubules lined by large irregular non-ciliated cells which have a large, clear, round nucleus with a prominent large nucleolus. The cytoplasm of these cells is strongly vacuolated, often with food vacuoles. Phagocytes are common among these cells and also in the connective tissue surrounding the diverticulae. They are small with a darkly staining nucleus containing many granules of chromatin and surrounded by very little cytoplasm.

In cross-section the tubules are circular to ellipsoid, their lumen being also circular to ellipsoid, not tripartite or cruciform as described by Yonge (1926) in *Ostrea edulis*. The crypts of darkly staining cells mentioned by Yonge are not present. Instead, darkly staining cells occur about the periphery of the tubules, usually concentrated to one side or at either end. The remainder of the cells have a lightly staining cytoplasm. Yonge found in *Ostrea* that these dark staining cells were the younger cells, the areas in which they occur being areas of cell proliferation. (Fig. 3.)

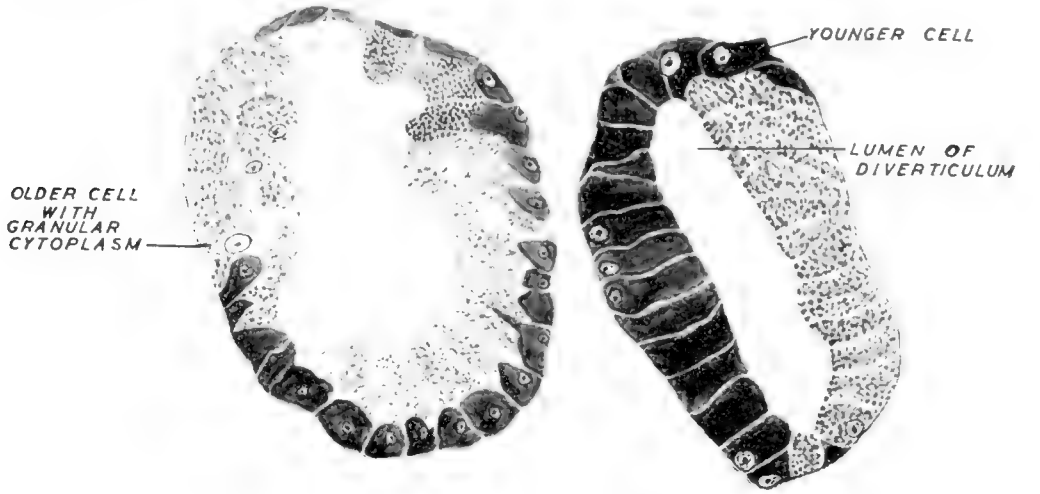


FIG. 3- T.S. DIGESTIVE DIVERTICULAE X700 (*K. SCALARINA*)

The diverticulae are connected to the ducts by short narrow tubules lined with short ciliated columnar epithelial cells similar to those found in the stomach and the ducts. The tubules enter the ducts separately. The later have, in cross section, an irregularly shaped lumen, possibly due to variation in the size of the epithelial cells.

The vertical limb of the intestine which leaves the stomach at its posterior end consists of two compartments partially separated from each other by two ridges or typhlosoles. The large compartment is the style sac, the smaller the intestinal groove.

The epithelia lining these two compartments differ although they are both composed of a single layer of ciliated columnar epithelial cells. Those of the style sac are tall with large oval nuclei, having a prominent nucleolus and a faint network of chromatin, and situated in the lower half of the cell. The cilia are long, straight and very numerous arising from a row of basal granules near the outer border of the cells. The most noticeable feature of the cilia is that they are all the same length, the style resting on the surface so formed. (Fig. 4.)

FIG. 4 - T.S. WALL OF MID GUT, STYLE SAC X 700
(*K. SCALARINA*)

At the typhlosoles the nature of the cilia changes, and the cells lining the intestinal groove are shorter, the cilia sparser and less uniform. The left typhlosole is the larger, projecting further into the lumen. It consists of a thickening of the underlying connective tissue and muscle covered by ciliated

columnar epithelial cells similar to those of the intestinal groove. The smaller right typhlosole is formed by a group of very tall columnar epithelial cells, supported to some extent by a slight thickening of the underlying tissues. A few of these tall cells are seen on the posterior surface of the left typhlosole.

It is interesting to note that the relation of the style sac to the intestinal groove is very similar to that shown by Matthais (1914, Fig. 77) for *Arca barbata,* rather than to that of *Ostrea edulis* (Yonge, 1926B) or that of *Anodonta cellensis* (Gutheil, 1912) and *Anodonta grandis, Lampsilis luleetus* and *Lampsilis anodontoides* (Nelson, 1918). Systematically these latter forms are more closely related to *Katelysia scalarina* than is *Arca barbata.*

Phagocytes are very numerous both in and beneath the epithelium of the intestinal groove and were less numerous in the epithelium of the style sac. Some of the phagocytes, especially those near the typhlosoles contain large brown-green granules about 0·0078 mm. in diameter. These granules are spherical in shape and occur throughout the body of the animal particularly in the intenstinal epithelium, in the blood vessels and the renal organ. MacMunn (1900) maintains that they are composed of a substance related to chlorophyll and called by him entero-chlorophyll. He believes it to be a derivative of ingested chlorophyll. Zachs (1955) in a paper on the cytochemistry of *Venus mercenaria* has summarized the past observations on this pigment and has shown for *V. mercenaria* that this pigment is allied to ceroid, a substance produced during the cirrhosis of rat's liver and first described by Lillie and his co-workers (1941, 1942). Prior to this, several workers, Metchnikoff (1884), Grobben (1887) and Yonge (1926 A and B) had observed these pigment masses in various organs of molluscs. In lamellibranchs they occur primarily in the blood vessels and tissues of the digestive gland, intestine, heart and kidney.

The crystalline style has not been studied in detail as it was not directly related to the subject and much has already been done on this aspect of molluscan anatomy (Nelson, 1918). Although the style was not dissected out, it was seen in a section cut through the stomach and appeared as a more or less homogenous translucent mass. The style sac ends just after the coiling of the intestine and the intestine continues as the mid gut.

The mid gut is characterized by a large typhlosole occupying the greater part of the lumen of the gut. Unlike that described by Yonge (1926) for *Ostrea edulis,* the typhlosole is not bilobed. It is composed mainly of connective tissue and some muscle fibres, the latter tending to be concentrated in the centre of the typhlosole. Scattered throughout the connective tissue are numerous phagocytes.

The epithelium of the mid gut is composed of columnar cells similar to those lining the stomach although the cilia are longer, being nearly half the length of the cell. The cells rest on a very thick basement membrane which is underlain by a layer of circular muscle in the typhlosole. Through the epithelium, basement membrane and muscle layer there are numerous phagocytes, many containing large inclusions of the brown-green ceroid-like excretory pigment. (Fig. 5.)

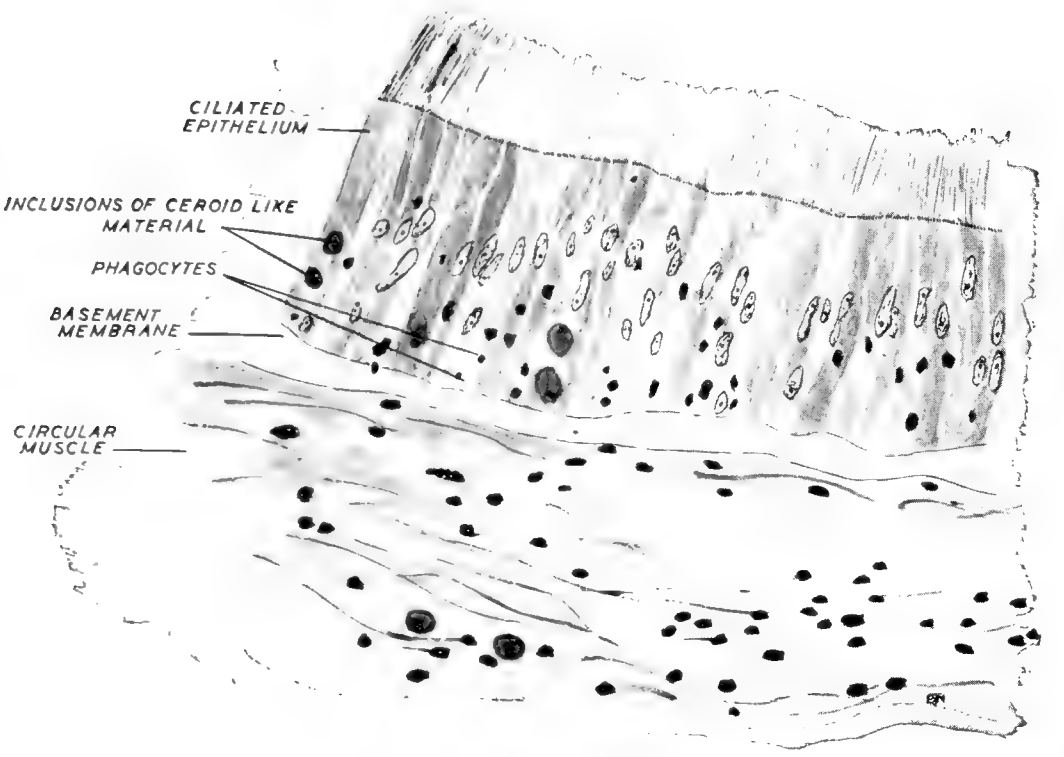


FIG. 5 - T.S. WALL OF MID GUT, TYPHLOSOLE. X 700
(*K. SCALARINA*)

The rectum is circular in cross section and the lumen is likewise. There is no evidence of a typhlosole anywhere, the lumen being lined by columnar cells with short cilia. Here the phagocytes are even more numerous, occurring both in the epithelium and the lumen of the rectum, many containing brown granules. There is a very narrow basement membrane surrounded by a thick layer of circular muscle.

Vascular System:

The heart lies in the pericardial cavity which is dorsal, lying immediately anterior to the posterior adductor muscle and is similar to most lamellibranch hearts (White, 1928). It consists of a ventricle and a pair of auricles. The ventricle has thick spongy muscular walls while the auricles, opening into either side of the ventricle by narrow transverse slits, have thin transparent walls. The rectum passes through the ventricle.

The arterial system was traced by injecting a suspension of red poster paint in sea water into the ventricle, the method used being a modification of that used by Awati and Rae for *Ostrea cucullata*. The arteries were subsequently dissected. Most of the main arteries were clearly revealed by this method but the pedal artery was filled only in one specimen and those to the mantle and siphons did not fill at all. (Fig. 6.)

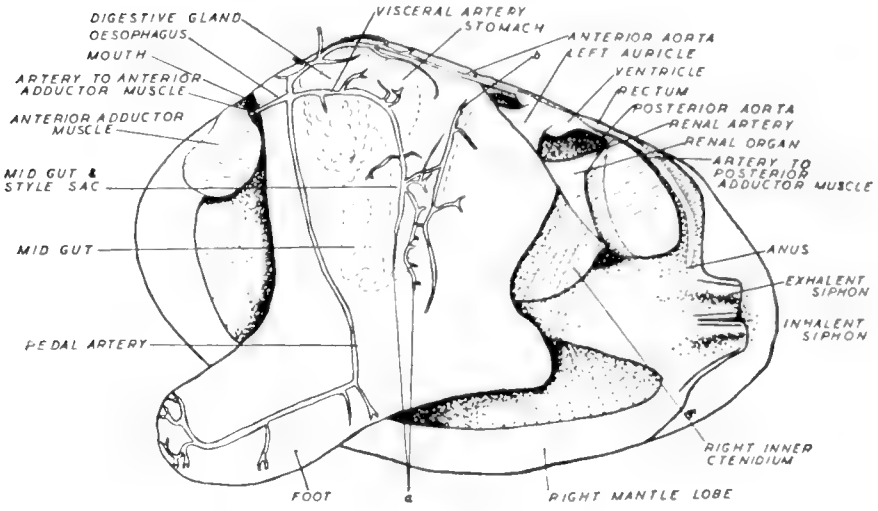


FIG. 6 - ARTERIAL SYSTEM, *K. SCALARINA*

From the ventricle two main arteries arise, the anterior and posterior aortae. The anterior aorta leaves the ventricle on the dorsal side of the rectum and runs along the dorsal surfaces of the rectum until it enters the visceral mass. From here it continues along the dorsal side of the visceral mass just below the body epithelium giving off several small branches to the surrounding tissues and to the rectum. It passes dorsal to the digestive gland and on the anterior side of this organ turns in a ventral direction dividing into three branches—one to the anterior adductor muscle; one to the foot, the pedal artery; and one to the viscera, the visceral artery.

The artery to the anterior adductor muscle is short and enters the muscle immediately after leaving the visceral mass. The pedal artery runs parallel to the anterior margin of the visceral mass until it reaches the foot where it runs parallel to the ventral margin of the foot and after giving off several small branches finally divides into small vessels at the tip of the foot.

The visceral artery is a large artery which passes posteriorly through the digestive gland, giving off branches to the stomach and digestive gland. It then travels down the style sac dividing into four branches about halfway along the style sac. One of these branches is very short serving the surrounding gonads while the other three extend over the alimentary canal bringing blood to the mid gut and rectum.

The posterior aorta runs along the ventral surface of the rectum giving one branch to the renal organ before entering the posterior adductor muscle. Halfway between the ventricle and the renal artery there is a curious outgrowth on the ventral aorta, the aortic bulb, the function of which is unknown.

Owing to difficulty in determining a suitable point of injection the venous system has not been investigated.

Nervous System:

The nervous system of the two species is essentially the same and a full description will be found in the description of *K. rhytiphora*.

Ctenidia:

The ctenidia are strongly plicate and the central plicae of the inner demibranch average 26 filaments to each plica. The filaments are typical of the Eulamellibranchiata and are similar to those of *Venus callophylla* illustrated by Ridewood (1903). There are no principal filaments.

The ciliation of the ctenidia was not studied as attempts at determining the direction of the food currents proved unsuccessful. Two methods were tried, that described by Atkins (1936, 1937 A and B, 1938 and 1943) and that used by MacGinitie (1941, 1945).

Katelysia rhytiphora Lamy, 1935.

Venus corrugata Lamarck 1818 (non Gmelin) (p. 594, No. 34).

Venus aphrodina Lamarck 1818 as described by Hanley 1842, 1856 (p. 126, pl. 16, fig. 33).

Venus strigosa Sowerby 1855 (p. 736, No. 99, pl. 162, fig. 222, 223); Reeve 1864 (pl. 20, sp. 94) (non Lamarck 1818).

Chione strigosa Pritchard and Gatliff 1903 (p. 126, p. 94, pl. 15, fig. 5, 6).

Tapes victoriae Pritchard and Gatliff 1903 (p. 126) (non Tenison Woods 1878).

Marcia (*Katelysia*) *corrugata* Jukes-Brown 1914 (p. 88).

Marcia corrugata May 1921, 1923 (p. 23, No. 176, pl. 10, fig. 13).

Katelysia enigma Iredale 1936 (p. 278); Allan 1950 (p. 331, p. 326, fig. 77, No. 8).

Katelysia strigosa Macpherson and Chapple 1951 (p. 152).

Katelysia rhytiphora Macpherson 1958 (p. 14, pl. 10, No. 13).

Shell:

Shell equivalve, inequilateral, anterior dorsal margin more than half the length of the posterior dorsal margin. The angle at the umbos between the two dorsal margins averages 131 deg. The ventral margin is smooth flatly convex; the posterior and anterior margins are rounded. The hinge line is typical of the family with three cardinal teeth in each valve $\frac{\text{L } 101010}{\text{R } 010101}$; there are no laterals. The central cardinal tooth in both valves is very slightly bifid and extends to the edge of the hinge plate. The two outside cardinals are set at equal acute angles to the central tooth and all tend to be slightly curved. The ligament is external and typical of the family. The lunule is lanceolate well defined but darker in colour than the rest of the shell. The escutcheon is narrow and inconspicuous. The shell sculpture consists of concentric rounded coarse ridges tending to unite towards the posterior margin. These ridges are crossed by coarse radial costae which are characteristic of the species. Internally the adductor muscle scars and the pallial line are pronounced, the pallial sinus being moderately deep and wide.

The outside of the shell is cream with black angular markings covering most of the shell, while the inside is yellow with purple about the anterior and posterior dorsal margins and also the adductor muscle scars. In some forms such as those from Port Arthur, Tasmania the whole interior is deep purple.

The variation within this species is not as great as that in the previous species. Shells from New South Wales, both recent and sub-recent, are in general more swollen than the Victorian form, particularly towards the umbos and the radial costae are very close together. This form seems to be restricted to the east coast of New South Wales being recorded as far south as Eden. The Victorian form of the species is similar to that of the type but changes occurring as the species is followed east and west are not sufficiently marked to warrant further sub-division of the species.

Most of the specimens seen from South Australia were from St. Vincent's Gulf, particularly about Adelaide. The valves are flatter, the concentric ridges broader and stronger and the radial costae coarser. Specimens from Eyre Island were shorter anteriorly resulting in the anterior dorsal and posterior dorsal margins being almost equal in length.

The species is rare in Western Australia. Specimens from here differ from the Victorian forms in that the concentric ridges are broader, the external surface more polished and the posterior end more pointed. The external colouration also varies although basically typical of the species. The shells are lighter in colour and often the posterior end of the shell is brown. In the shells from Port Arthur, Tasmania the central cardinal tooth in the left valve is often strongly bifurcated and the valves shorter dorsoventrally, often thick. The colouration varies considerably, from that of the type to the deep purple inside and grey-green outside, common to all species at Port Arthur.

Distribution:

The range of *K. rhytiphora* is similar to that of *K. scalarina*. (Fig. 7.) In New South Wales it is not recorded further north than Sydney, occurring there mainly as sub-recent valves washed up on the beach. The only other record from New South Wales is a live specimen from near Eden.

In Victoria the species is plentiful particularly in Port Phillip and also in some localities of Western Port. It is also found in the more sheltered inlets, bays and gulfs of the South Australian coast particularly St. Vincent's Gulf. It occurs in the Pleistocene deposits of this state although Crocker and Cotton did not record it. In a deposit five miles west of Lake St. Claire, mentioned earlier, *K. rhytiphora* is more common than *K. scalarina*.

FIG 7 - DISTRIBUTION OF K RHYTIPHORA & K.PERONII

The species is not common in Western Australia and has been recorded only from one locality, Emu Point near Albany. In Tasmania the distribution of this species is slightly different from that of the former species. *K. rhytiphora* seems to be more restricted to the southern coast while *K. scalarina* occurs both on the northern and southern portions of the coast.

Ecology:

The habitat of this species is different from that of *K. scalarina* although there is a slight overlap. Of the localities visited by the writer, Mornington is the only one where both species are found. Here, as mentioned above, *K. scalarina* is found between the tide marks while below the lower limits of this band, *K. rhytiphora* occur often buried in the *Zostera,* a few living among the *K. scalarina.*

At Flinders, Western Port, *K. rhytiphora* is found buried in a grey muddy sand near banks of *Zostera* on the north west side of West Head, just north of the end of the basalt wave platform at the base of West Head. Here they are uncovered only at low spring tides, the only other bivalve associated with them being *Zemyria tasmanica.*

Another locality visited by the writer was Geelong where the *K. rhytiphora* were living well below low tide in about a metre of water. Here again they were buried in a muddy sand, this time associated with *Eumarcia fumigata* and *Philine angasi,* the latter being quite plentiful.

Occasionally when *K. rhytiphora* is the only member of the genus in the locality, as for example at Rickett's Point, Port Phillip, a few individuals are found between the tide marks, often being detected by a growth of *Ulva lactucea* on the posterior end of the shell. The commensal sea-anemone associated with *K. scalarina* does not occur on *K. rhytiphora* even when the two species are closely associated as they are at Mornington.

Animal Morphology.

The external morphology of the animal of *K. rhytiphora* does not differ greatly from that of *K. scalarina.* The epithelium lining the inside of the siphons lacks the black pigment found in *K. scalarina.* The foot is similar in shape to that of *K. scalarina* although it is shorter in the dorsal ventral direction and longer in the anterior-posterior direction. The external aperture of the exhalent siphon is similar to that of *K. scalarina* (Fig. 8).

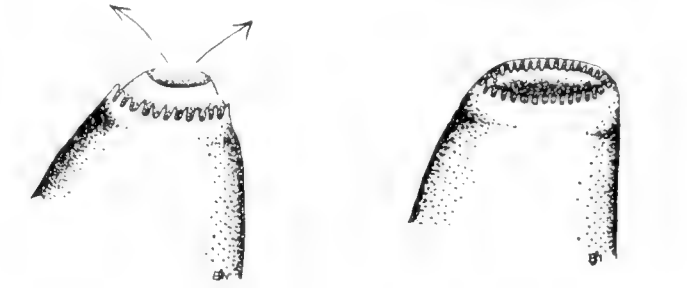


FIG. 8 - EXHALENT SIPHON X 12 (*K. RHYTIPHORA*)

ANATOMY AND HISTOLOGY.

Alimentary Canal and Associated Organs:

The alimentary canal does not differ greatly from that of *K. scalarina* and will not be described.

Vascular System:

In general plan the heart and arterial system are similar to that of *K. scalarina.* There are some differences in the arterial system and these will be described in detail.

The arterial system was traced in the same way as that of *K. scalarina.* Unfortunately while most of the main arteries were revealed in this species, those of the foot and mantle did not fill with the injected material. It is assumed that the pedal artery takes a similar course to that of *K. scalarina.* (Fig. 9.)

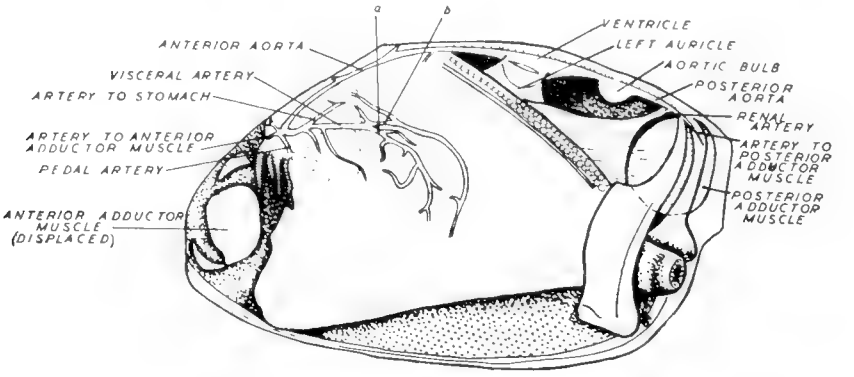


FIG. 9 - ARTERIAL SYSTEM, *K. RHYTIPHORA*

The anterior aorta after it passes through the digestive gland gives off two important branches, the artery to the stomach and the larger visceral artery which takes blood to the intestine. This visceral artery has two main branches which correspond to *a* and *b* in Schanecke's description of the arterial system of *Anodonta cellensis* (Schanecke, 1913). Branch *a* of the visceral artery serves the coiled portion of the intestine lying in the ventral part of the visceral cavity as well as giving off numerous small branches to the surrounding tissues including the gonads and the body wall. Branch *b* of this artery immediately divides into two, one branch passing dorsally to take blood to the stomach and also the dorsal ascending posterior portion of the intestine. The other branch extends ventrally serving the ventral ascending portion of the intestine and the coiled intestine. Anterior to the junction of branches *a* and *b* the visceral artery gives off three branches two of which serve the digestive gland, the third passing through this gland into the gonads surrounding the digestive gland.

Nervous System.

The dissection of the nervous system was made on animals fixed in Müller's fluid. The advantage of this fixative over formalin is that the ganglia particularly and also the nerves to a lesser extent take up the orange potassium dichromate and are easily distinguished against the white of the muscles. Also the tissues are not distorted during fixation. A disadvantage is that fixation is very slow, the time used for *K. rhytiphora* being about the minimum.

The nervous system was compared with that of *Tagelus dunbeyi* (Solenidae) and *Pholas dactylus* (Pholadidae) described by Haas (1935, Fig. 503 and 505, p. 878 and 879) Stempel (1912) and Forster (1914). In general it is more like that of *Pholas dactylus* (L) and most of the names for the nerves have been taken from Forster (1914).

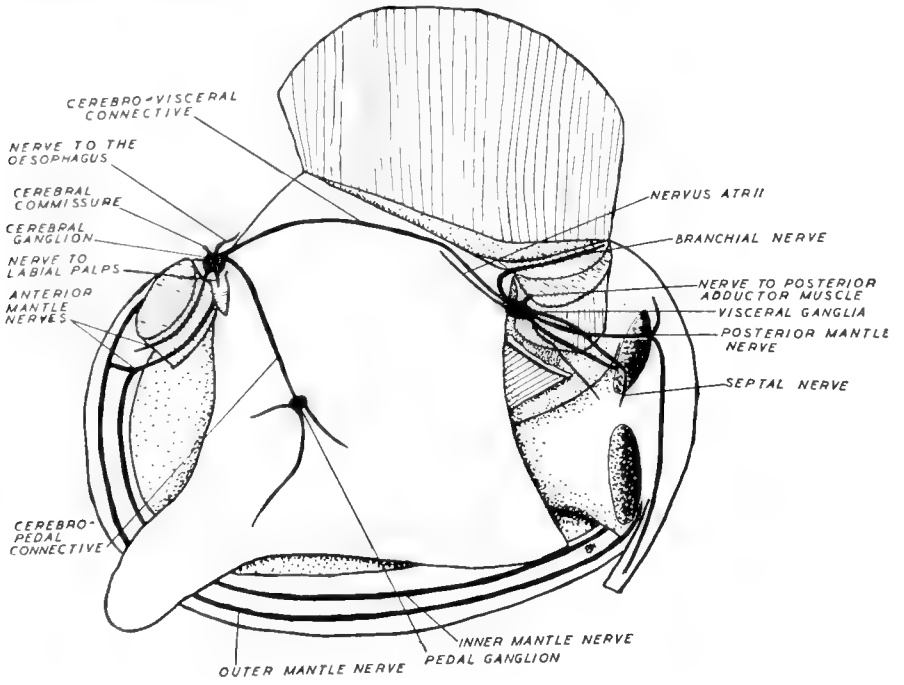


FIG 10 - NERVOUS SYSTEM, *K RHYTIPHORA*

Ctenidia:

The structure of the ctenidia is similar to that of *K. scalarina*. However, the central plicae of the inner demibranch average 21 filaments to each plica compared with 26 in *K. scalarina*.

Mantle Edge and Siphons:

The morphology of the mantle edge and siphons has been described already. The histology of these organs has been considered in the light of Yonge's note (1948) in which he gives the structure of the mantle and postulates the fusion of the lobes to give the siphons. It was decided to section both mantle edge and siphons to see if, in fact, these three divisions of the mantle edge were distinguishable histologically. The diagram given by Yonge is very generalized and seems to indicate that the radial muscles only extend from the inner lobe to the pallial line but in *Katelysia* some extend from the outer lobe (that is, the lobe applied closely to the shell) to the pallial line so that both the inner and outer lobes are muscular.

Likewise the presence of a middle sensory lobe is open to question as there does not seem to be a particular concentration of nervous tissue in this lobe. As can be seen from Fig. 10 there are two mantle nerves on which there are occasional small ganglia. Nerves from these ganglia serve the tentacles and muscles of the mantle edge.

Sections through the siphons show that there are giant nerve fibres in the nerves to the siphons from the visceral ganglia.

Pedal Gland:

Along the ventral edge of the foot there is a ciliated groove extending from the centre of the foot in an anterior direction for about 6–7 mm. This groove contains at its posterior end the pedal gland which corresponds with the byssal gland of sessile forms such as *Mytilus*, *Arca* and *Pinctada*. There is no evidence of a byssus in *Katelysia*. Sections through the gland show that the cells forming it are columnar with a prominent, darkly staining nucleus. The cytoplasm of the cells is packed with golden brown granules. The nature of these granules is unknown although they do not appear to resemble the ceroid material observed in other parts of the body. Both species have this gland and groove.

Statistical analysis of shell measurements of *K. scalarina* and *K. rhytiphora*.

A statistical analysis of five shell measurements was made on 331 specimens of *K. scalarina* and 359 specimens of *K. rhytiphora* in order to determine whether there was a constant difference in the form of the shell.

The measurements made were:—

I. Length of shell (anterior to posterior).
II. Distance from posterior edge to umbos.
III. Distance from anterior edge to umbos.
IV. Width (Left to right).
V. Angle at umbos.

The three principal ganglia are paired. Usually members of a pair are closely applied to one another. However the cerebral ganglia are found one on either side of the oesophagus just posterior to the mouth and are connected to each other by the cerebral connective dorsal to the oesophagus. (Fig. 10.)

The cerebral ganglia are connected by paired cerebro-pedal connectives to the pedal ganglia which lie in the muscular body wall just anterior to the visceral cavity and about half-way between the dorsal and ventral margins of the body. The cerebral ganglia are also connected to the visceral ganglia by the paired cerebro-visceral connectives which run on either side of the body, just below the thin muscular body wall covering the digestive gland. Just posterior to the genital aperture this connective passes through the renal organ, running along its ventral margin until the connective joins the visceral ganglia. Other nerves, the anterior mantle nerves, leave the anterior side of the cerebral ganglia and after passing over the posterior surface of the anterior adductor muscle, branch into the inner and outer mantle nerves serving the mantle edge. There are two other pairs of shorter nerves leaving the cerebral ganglia. One pair is dorsal and innervates the oesophagus. The other pair is ventral, the nerve origins lying between those of the anterior mantle nerve and the cerebro-pedal connectives. This pair innervates the labial palps.

The pedal ganglia give rise to three pairs of nerves, one passing anterior into the body wall, another ventrally to the foot and a third posteriorly to the intestine. There does not appear to be pairs of statocysts associated with the pedal ganglia, as recorded in some forms such as *Nucula nucleus* (L) (Pelseneer, 1891) and *Spondylus* (Dakin, 1928) but these may be undetected due to small size.

The visceral ganglia are conspicuous lying in the connective tissue covering the ventral surface of the adductor muscle. Just ventral to the origin of the cerebro-visceral connective there is a small nerve which seems to correspond to the nervus atrii of Stempell (1912). Dorsal to the origin of the cerebro-visceral connective the branchial nerves leave the visceral ganglia and pass across through connective tissue onto the inner dorsal side of the inner gill ctenidium and there turn posteriorly to the gill margin.

A pair of short nerves leaves the dorsal side of the visceral ganglia and passes straight into the posterior adductor muscle. Posteriorly two pairs of nerves leave the ganglia. One pair, the posterior mantle nerves, passes over the ventral surface of the posterior adductor muscle and through the connective tissue about the inner aperture of the exhalent siphon to the mantle where each nerve divides in two, a branch passing to the dorsal portion of the mantle, another ventrally to join with the outer mantle nerve from the anterior mantle nerve. The other pairs of nerves each lie to the outside of the posterior mantle nerves and cross the latter before entering the septum between the inner aperture of the two siphons. These nerves seem to correspond to the septal nerves of Forster (1914) and pass up the siphon walls innervating the siphons. It is not certain whether a branch from this nerve also joins with the inner mantle nerve of the anterior mantle nerve.

The histology of the nervous system has not been studied in detail although in a series of sections through the whole animal the gross structure of the cerebral ganglia was revealed. Most of the nerve cells seem to be concentrated in the outer portion of the ganglia while the central region consists of a vast network of axons leading into the nerves serving the various organs.

The results of this analysis may be summarized as follows:—

	K. scalarina.	*K. rhytiphora.*
I. Length—		
Mean	28·30 ± 0·31 mm.	31·98 ± 0·41 mm.
Standard Deviation	5·71 mm.	7·73 mm.
II. Posterior edge-umbos—		
Mean	25·88 ± 0·29 mm.	26·92 ± 0·35 mm.
Standard Deviation	5·35 mm.	6·64 mm.
III. Anterior edge-umbos—		
Mean	11·84 ± 0·13 mm.	12·90 ± 0·16 mm.
Standard Deviation	2·28 mm.	3·02 mm.
IV. Width—		
Mean	12·61 ± 0·14 mm.	13·84 ± 0·20 mm.
Standard Deviation	2·58 mm.	3·78 mm.
V. Angle at umbos		
Mean	114·38 ± 0·42°	131·57 ± 0·27°
Standard Deviation	7·57°	5·17°

ANALYSIS OF THE DIFFERENCE BETWEEN THE TWO SAMPLES.

(*a*) *Comparison of Means.*

As a simple rule it can be stated that two samples are probably different if the difference between the means (m_1—m_2) is more than twice the sum of the standard errors ($SEm_1 + SEm_2$) and almost certainly different if it is more than three times the sum of the standard errors. (Mayr, Lindsley and Usinger, 1953).

The fraction $\frac{\text{Difference between means}}{\text{Sum of SEm}}$ gives the following figures:—

I. Length	5·1
II. Posterior edge-umbos	1·6
III. Anterior edge-umbos	3·6
IV. Width	3·6
V. Angle at the umbos	24·9

Since four of the five measurements made show a difference between the means which is greater than three times the sum of the standard errors, the samples are almost certainly from different populations.

(*b*) *Overlap of Population.*

Using the coefficient of difference (C.D.) as defined by Mayr, Lindsley and Usinger (p. 145–146) the following results were obtained:—

	C. D.	Joint Non-overlap.
I. Length	0·3	Less than 75 per cent.
II. Posterior edge-umbos	0·1	Less than 75 per cent.
III. Anterior edge-umbos	0·2	Less than 75 per cent.
IV. Width	0·2	Less than 75 per cent.
V. Angle	1·35	91 per cent.

A further study of the results of the first two measurements taken as $\frac{\text{Posterior edge-umbos}}{\text{Length}} \times 100$ gave the following:—

VI. $\frac{\text{Posterior edge-umbos}}{\text{Length.}}$	1·19	88·5 per cent.

From these results it can be seen that the angle at the umbos may be used as a character for distinguishing the two species.

Breeding in *Katelysia scalarina* and *Katelysia rhytiphora*.

In order to determine the breeding cycles of the two species a monthly survey of the population at Mornington was started in September, 1955 and continued more or less regularly for *K. scalarina* up to the beginning of October, 1956. Unfortunately the number of *K. rhytiphora* available was not great and after June, 1956, gave out completely. Apart from the original aim of this survey it has been possible to consider the type of sexuality present in the species and in November, 1955 to carry out experiments in cross fertilization between the two species.

As in most lamellibranchs the gonad in both sexes consists of a vast network of ramifying tubes eventually forming a common duct which opens to the exterior onto a small genital papilla just near the anterior end of the renal organ. The gonads are paired and at maturity completely fill every available space in the body cavity, covering the intestine and digestive gland, and extending right up into the umbos of the shell causing considerable extension of the body wall. They do not extend into the mantle as in *Mytilus*.

There is little apparent macroscopic difference between the two sexes. Unlike *Spondylus, Pecten* and *Chlamys* there is no difference in the colour of the gonad; in both species it is pale cream. However, there is a slight difference in the texture of the gonad apparent through the body wall particularly in mature specimens. In the female the tubules of the gonad are distinct while those of the male are suffuse and tightly packed. There is no difference in the shells of the two sexes as in some members of the family *Carditiidae* (Dall, 1902).

Unlike many of the *Ostreidae* the larvae are not retained within the mantle cavity. The genital products are discharged into the sea where fertilization occurs. At present the length of the larval period is unknown, as are the larval stages.

During this survey one hundred specimens of *K. scalarina* were collected on each visit to Mornington, as well as any *K. rhytiphora* available. They were preserved in 5 per cent. formalin. Subsequently the length of each shell was determined, the animal sexed by microscopical examination of gonad smears and the developmental stage of the gonad estimated. This last part was done by devising an arbitrary series of developmental stages similar to that used by Orton, Southward and Dodd (1956) for *Patella vulgata*. These stages were as follows:—

	Stage Number.	Condition of Gonad.
Prior to Spawning	1.	Body cavity empty of genital products (includes immature individuals).
	2.	Body cavity partly full—digestive gland completely uncovered.
	3.	Body cavity partially full—portion of digestive gland still showing.
	4.	Body cavity full but not strongly distended—digestive gland completely covered.
Spawning commences.	5.	Body cavity packed with mature products, body wall strongly distended and hard to the touch.
Spawning and post spawning.	IV.	One gonad half empty.
	III.	Both gonads half empty.
	II.	Both gonads almost fully discharged.
	I.	Both gonads empty—body wall loose.

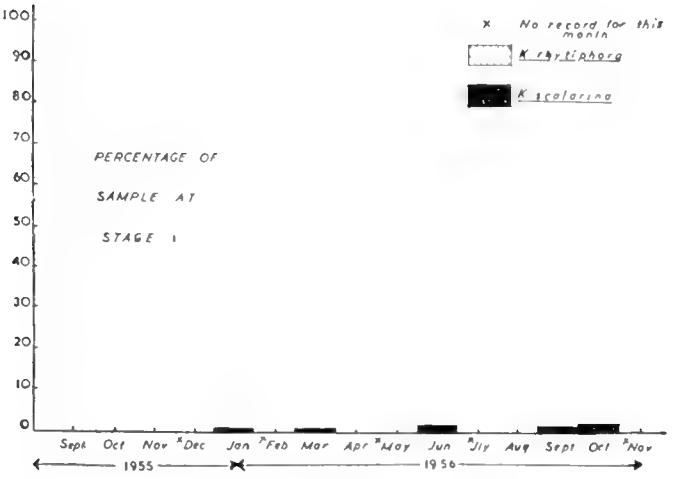

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE 1
x No record for this month
K rhytiphora
K scalarina
Sept Oct Nov x Dec Jan x Feb Mar Apr x May Jun x Jly Aug Sept Oct x Nov
1955
1956

FIG. 11

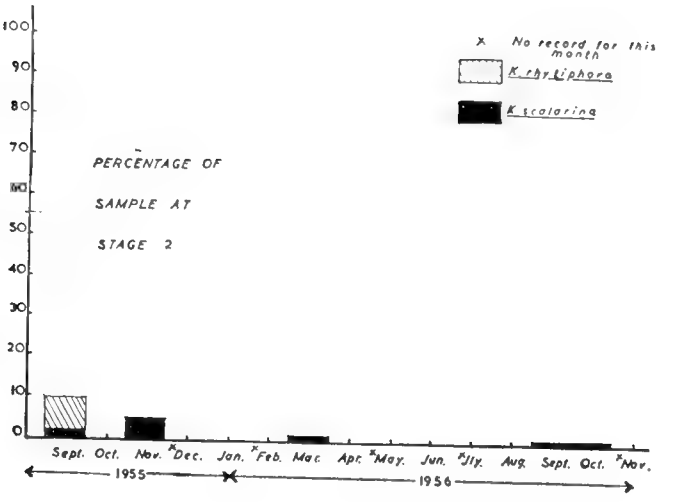

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE 2
x No record for this month
K rhytiphora
K scalarina
Sept. Oct. Nov. x Dec. Jan. x Feb. Mar. Apr. x May. Jun. x Jly. Aug. Sept. Oct. x Nov.
1955
1956

FIG. 12

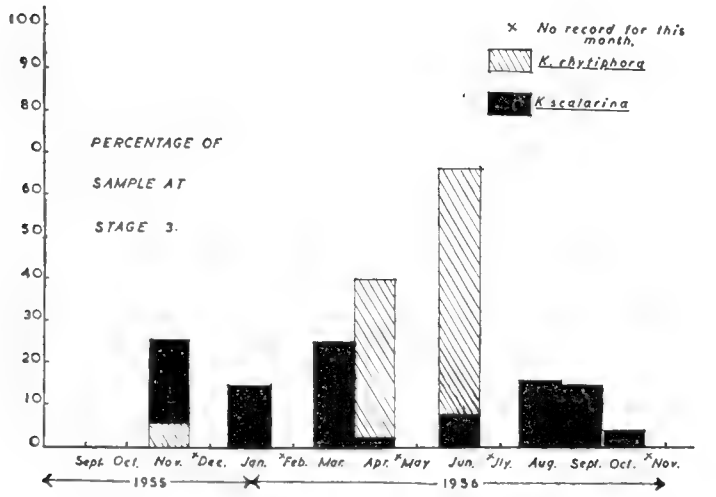

100
90
80
0
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE 3.
× No record for this month.
K. rhytiphora
K. scalarina
Sept. Oct. Nov. ×Dec. Jan. ×Feb. Mar. Apr. ×May Jun. ×Jly. Aug. Sept. Oct. ×Nov.
1955
1956

FIG. 13

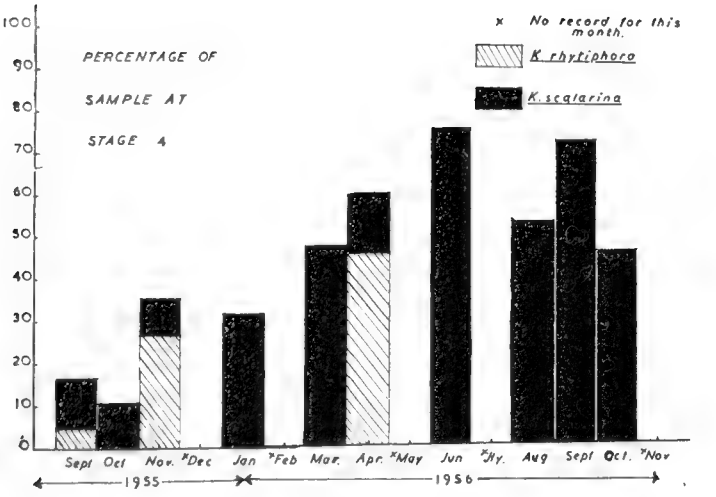

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE 4
× No record for this month.
K. rhytiphora
K. scalarina
Sept Oct Nov. ×Dec Jan ×Feb Mar. Apr. ×May Jun ×Jly. Aug Sept Oct. ×Nov
1955
1956

FIG. 14

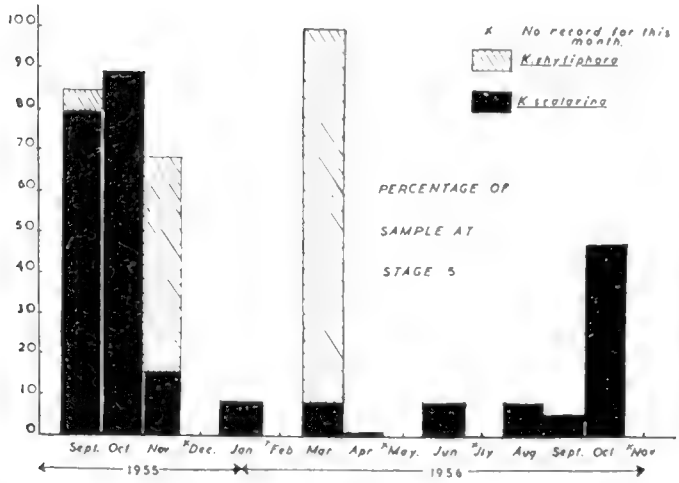

100
90
80
70
60
50
40
30
20
10
0
x No record for this month
K rhytiphora
K scalarina
PERCENTAGE OF
SAMPLE AT
STAGE 5
Sept. Oct Nov x Dec. Jan x Feb Mar Apr x May. Jun x Jly Aug Sept. Oct x Nov
1955
1956

FIG 15

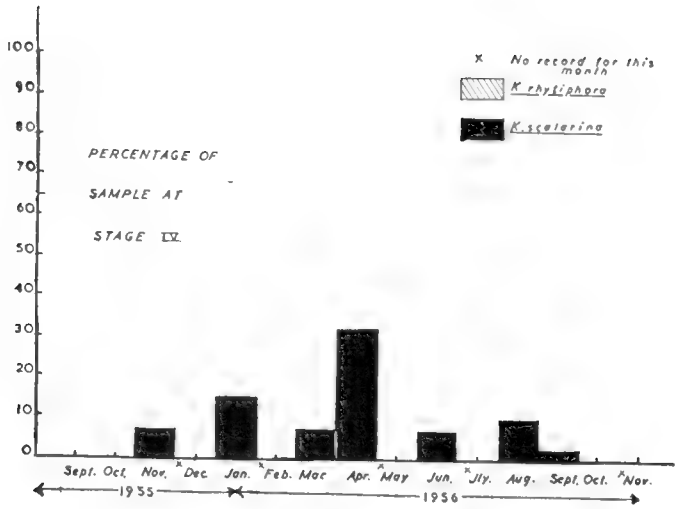

100
90
80
70
60
50
40
30
20
10
0
x No record for this month
K rhytiphora
K scalarina
PERCENTAGE OF
SAMPLE AT
STAGE IV
Sept. Oct. Nov. x Dec. Jan. x Feb. Mac Apr. x May Jun. x Jly. Aug. Sept. Oct. x Nov.
1955
1956

FIG. 16

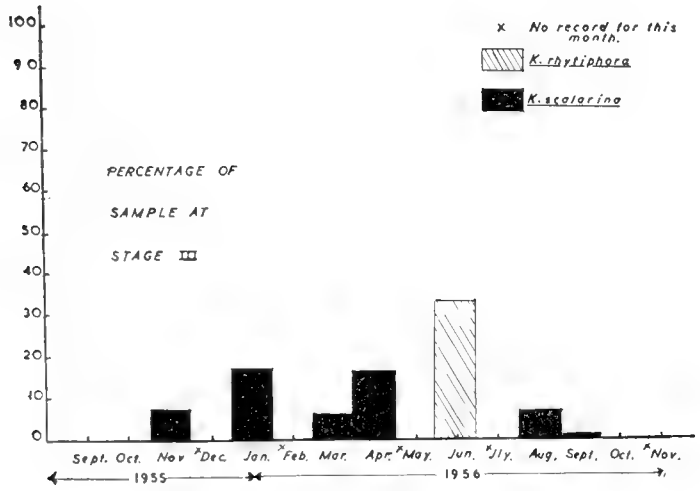

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE III
x No record for this month.
K. rhytiphora
K. scalarina
Sept. Oct. Nov. xDec. Jan. xFeb. Mar. Apr. xMay. Jun. xJly. Aug. Sept. Oct. xNov.
1955
1956

FIG. 17

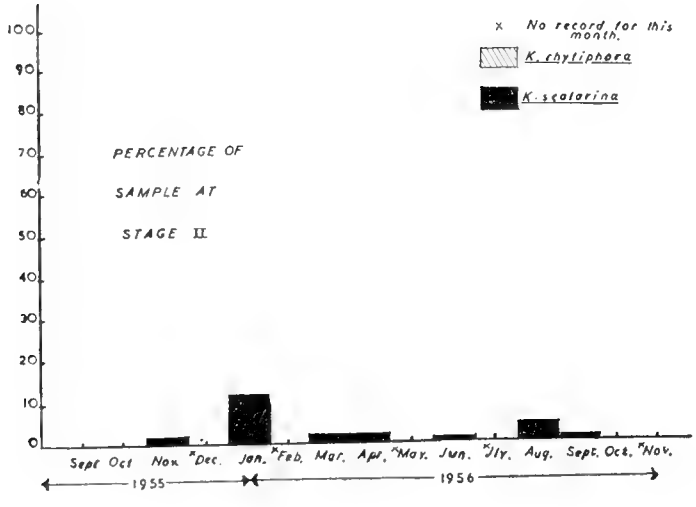

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE OF
SAMPLE AT
STAGE II
x No record for this month.
K. rhytiphora
K. scalarina
Sept Oct Nov xDec. Jan. xFeb. Mar. Apr. xMay. Jun. xJly. Aug. Sept. Oct. xNov.
1955
1956

FIG. 18

A certain amount of difficulty was experienced in distinguishing stages 4 and IV., but usually spawning animals could be distinguished by the fact that the body wall was flaccid and one or both gonads half empty. The condition of the body was used as a criterion in all the spawning and post spawning stages. Figures 11 to 19 show the results of this survey.

Figure 15 shows that the main spawning period for *K. scalarina* is in September–October, maturity being reached slightly later in 1956. There is a possibility that another secondary spawning period may occur in March particularly for *K. rhytiphora*. In fact there appears to be no time at which the gonads of the whole population are resting, i.e. in stages 1 or I. This indicates that there is no indeterminate period between the breeding seasons when the gonad is reduced and no genital products appear in sections. (Figures 11 and 19.) This "indeterminate" period has been recorded by Orton and his co-workers (1956) in *Patella vulgata* and also by Loosanoff (1942) in *Ostrea virginica*. Both these species are ambisexual and are described by Coe (1943, 1944) as exhibiting alternate sexuality. The absence of the "indeterminate" period in *K. scalarina* suggests that this species may not exhibit alternate sexuality although the presence of ambisexual individuals suggests that another type of ambisexuality could be present.

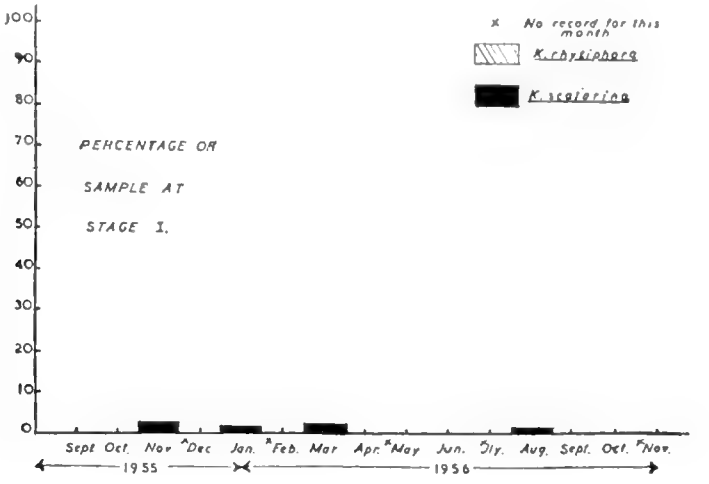


FIG. 19

Although no young individuals were obtained at Mornington Miss J. H. Macpherson of the National Museum of Victoria made available a collection from Venus Bay, South Australia collected on the 12th February, 1956. The shells of these animals averaged 18 mm. long. Of the 40 specimens collected, 15 were immature showing no gonad and of the 25 with gonad developed 9 were males and 16 females. This suggests that the species is not protandric as is *Venus mercenaria* Loosanoff (1937) where 98 per cent. of the population studied was protandric. However further work must be done before any definite conclusion can be reached.

As mentioned earlier the number of *K. rhytiphora* collected was relatively small. Despite this there are indications that the spawning periods are similar to those of *K. scalarina*. September, November and March appeared to be the main spawning periods.

Samples from the population of *K. scalarina* obtained each month showed that it consisted of male, female and ambisexual individuals.

The size range within the sexes was calculated. Of the total number of individuals collected, namely 993, 41·9 per cent. were female, 50·5 per cent. were male and 7·6 per cent. ambisexual. The mean size of the males was 30·4 mm. and that of the females 30·9 mm. Assuming that the length of the shell is directly proportional to age, these figures indicate that the individuals of each sex were approximately the same age. This again eliminates the possibility of ambisexuality being the dominant type of sexuality.

The proportion of male, female and ambisexual individuals was roughly the same for the 58 individuals of *K. rhytiphora* collected. Of these, 50 per cent. were female, 46·6 per cent. male and 3·4 per cent. ambisexual. The mean length of the males is 33·6 mm. and that of the females 33·8 mm. Thus the conclusions applied above to *K. scalarina* may also be applied to this species.

Perhaps the most interesting part of this work was the cross fertilization experiment carried out on the 10th November, 1955. For this experiment *K. scalarina* were collected at Mornington and *K. rhytiphora* at Ricketts Point. The animals were sexed and suspensions of ova and sperm of both species were made in sea water. After some time four separate crosses were made which were as follows:

Cross.	Sperm.	Ova.
1	*K. scalarina*	*K. scalarina*
2	*K. scalarina*	*K. rhytiphora*
3	*K. rhytiphora*	*K. scalarina*
4	*K. rhytiphora*	*K. rhytiphora*

Of these four crosses, Nos. 1 and 4 acted as controls while Nos. 2 and 3 were made to determine whether it was possible for cross fertilization to occur between the two species in the one locality.

After a time the ova in each cross were examined microscopically. Those from crosses 1 and 4 appeared the same, sperm being clustered about the periphery of each ovum. About half an hour later the first polar body was seen to form and the unsuccessful sperm disperse.

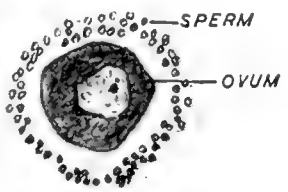


FIG. 20-RESULT OF CROSS 2

In crosses 2 and 3 very different results were seen. In 2 the sperm clustered in a ring about each ovum but at definite distance from it indicating that the ovum presumably secreted some bio-chemicals, which while attracting the sperm prevented them reaching the ovum and effecting fertilization (Fig. 20). The results of the third cross were negative.

Crosses 1 and 4 indicate that the sperm and ova used in the experiments were viable. The other two crosses (2 and 3) showed that the two species probably cannot interbreed and therefore are most probably separate biological species.

Paper partition chromatography.

In 1953 Buzzati-Traverso and Rechnitzer showed that comparisons of paper chromatograms obtained from tissue extracts of fishes indicated differences between species and the patterns so obtained were constant within a species irrespective of the size or age of the fish. The authors claim that comparable results were obtained in other phyla and suggest that the technique could be used to distinguish stocks of the same species belonging to geographically isolated populations. Buzzati-Traverso (1953) has also shown that paper chromatography of tissues of genetically known strains of *Drosophila melanogaster* and of certain plants gives a constant and distinctive pattern for each strain.

Following this work Kirk, Main and Beyer (1954) applied paper partition chromatography to seven species of land snails, two introduced species and five species native to Western Australia. The results of this work were in agreement with that of Buzzati-Traverso, the chromatograms obtained for each species being readily distinguishable from those of other species. They also compared chromatograms of one species from four widely separated localities and found no significant differences. Similarly differences in diet did not affect the resulting chromatograms for a particular species.

These results suggested that the method might be applicable to the present problem. Consequently several experiments were carried out with either adductor muscle or foot muscle from *K. rhytiphora* and *K. scalarina*.

Three techniques were tried including a modified version of the ascending chromatography described by Black, Lestrange and Zweig (1952). The most successful method was taken from Ceriotti (1956) which enabled a greater amount of tissue to be used and the chromatographing to be done at a slower rate thus allowing greater separation of the amino acids.

In this method a circle of Watermans No. 3 filter paper 24 cm. in diameter was held between two glass plates 25 cm. square, the lower one having a hole, 7 mm. in diameter, drilled in it. The material to be chromatographed was placed at the centre of the filter paper, above the hole in the lower glass plate and covered by a small circle of paper to prevent it coming in contact with the upper plate. A small circle of Watermans No. 3 filter paper was made into a cone and placed in a petri dish of solvent. The apex of the cone rested in the hole of the lower glass plate just touching the centre of the filter paper below the tissue. In all experiments the solvent was butanol : acetic acid : water (100:22:50 u/o) and they were carried out in a constant temperature of 22°C. The tissue used was dried for six hours in an oven at 100°C. and then ground to a fine powder. In both species the foot was used. For *K. rhytihpora* 11·8 mgr. were used and runs were for 3 hours 56 minutes; for *K. scalarina* 10·8 mgr. were used and the runs 3 hours 50 minutes long.

Ten chromatograms obtained were examined under ultra-violet light using a Hanovia 125 watt mercury vapour discharge lamp. The fluorescent and absorption bands were measured, 8 to 10 readings being taken on various radii of each chromatogram. The Rf values for each set of readings were calculated and the means for each species obtained. The means were as follows:—

	First fluorescent band. (cm.)	Second fluorescent band. (cm.)	Third fluorescent band. (cm.)
K. rhytiphora	0·58–0·53 Mean 0·55	0·40	0·30
K. scalarina	0·55	0·40	0·27

A comparison of the mean Rf value for each species shows that the differences are negligible, being the same for two fluorescent bands and only 00·3 different in the third. Also the fluorescent and absorption patterns and colours were the same for each species.

When considering the results of these experiments it must be remembered that the number of proteins in the animal body is great and that the solvent only removes a certain number which may or may not be those dependent on specific differences. Apart from the work of Buzzati–Traverso and Rechnitzer (1953), on fish, most of the later work has been done on *Drosophila melanogaster* and its mutant strains (Hadorn and Mitchell, 1951) and more particularly on lethal strains where abnormalities in the chemical equilibrium of the animal are present and there are, therefore, easily detectable differences. Thus the results of the above experiments do not indicate that there are no differences in the protein constitution of the two species only that the methods used have not revealed them. However until a suitable solvent is found this type of analysis is inapplicable to the present problem.

Commensal and parasitic animals associated with *K. scalarina* *K. rhytiphora.*

Only four commensal or parasitic animals were found in the course of this investigation and as yet the identification of each is arbitary or unknown.

The commensal sea anemone associated with *K. scalarina* was mentioned earlier, in the discussion of that species.

Both species were found to contain small crabs of the genus *Pinnotheres* (Family Pinnotheridae). There does not appear to be much literature on the Australian forms of this genus but from "The Crustaceans of South Australia" (Hale, 1927) the forms found seem to correspond with *Pinnotheres globosa* (Baker). However this species, according to Hale, is found in from five to ten fathoms of water in the molluscs *Chlamys bifrons, Spondylus tenellus* and *Modiolaria australis.* The specimens ranged from small immature females (2 mm. long) to larger mature animals 6 mm. long. Apart from occasional malformation of the ctenidia the crabs seem to have little affect on the *Katelysia.*

Encysted forms of an unknown parasite were observed in the blood vessels of the inner ctenidia of *K. rhytiphora.* These were seen only in sections. Likewise a small worm-like animal was found in a calcareous cyst in the body wall of a *K. scalarina.* This was thought to be of the phylum Acanthocephela.

Discussion.

The first part of this paper was written to sort out the complex synonymy of the three Australian species belonging to the genus *Katelysia.* Since writing, however, the writer has had access to two Japanese publications "Coloured Illustrations of the Shells of Japan" by Tetsuaki Kira (1959) and "An Illustrated Handbook of Shells in Natural Colours from the Japanese Islands and adjacent Territory" by Shintaro Hirase, revised and enlarged by Isao Taki (1954). These authors list among the lamellibranchs of Japan the species *Katelysia*

japonica Gmelin. As yet specimens of this species have not been examined and it is uncertain whether this species belongs in *Katelysia* sensu stricto or, as indicated by Kira, in *Hemitapes* Römer. Problems associated with this latter genus were mentioned earlier.

The particular investigation of the two species, *K. scalarina* and *K. rhytiphora* has shown that the shell features are sufficient criteria for separation of the two species, the experimental crossings having revealed that they probably cannot interbreed. Cotton and Godfrey (1938) comment that there is a gradation from *K. scalarina* to *K. rhytiphora* (*K. corrugata* in Cotton and Godfrey) but in all the specimens examined no such gradation of shell feature has been found.

However there is a wide variation in colouration both inside and outside; in the coarseness of ornamentation and in the convexity of the valves. This variation is dependent partly on local environmental conditions as for example estuarine conditions at Lakes Entrance, Victoria or those at Port Arthur, Tasmania. As yet the tolerance of the three species to changes in temperature and salinity is not known. Distribution suggests that they may be slightly tolerant to changes in salinity.

The anatomical studies did not reveal any marked differences in the gross anatomy of the animals though there were minor differences. The colouration of the siphons is different; the distribution and number of minor arteries, particularly to the visceral mass differs; the general shape of the visceral mass and foot is distinctive (corresponding to the shape and the dimensions of the shell) and the number of filaments to a plica of the inner ctenidia is different.

The results of the paper partition chromatography and the breeding survey have already been discussed. The breeding survey also showed that at no time were the populations devoid of mature and spawning individuals. This seems to indicate that breeding continues throughout the year with two periods of maximum activity in September–October and March.

This is different from the known breeding cycles of the Northern Hemisphere and suggests that at least in southern Australia there is a different breeding rhythm. Possibly there are no extremes in temperature sufficient to cause the cessation of breeding. Verification of this could possibly be made by determining the annual temperature range in Victorian and Tasmanian waters and investigating the breeding cycles of the same species in Tasmania.

The histological work revealed two points of general interest. The first is the mode of formation of the gastric shield. Two theories have been advanced, one by Yonge, the other by Gutheil. Although until the exact nature of the shield is determined biochemically, the mode of formation cannot be exactly given it seems from this work that Yonge's theory is highly improbable.

The other point is in connection with Yonge's suggestion that the mantle lobe is divided into muscular and sensory portions. This does not appear to be generally so and certainly in *Katelysia* there is no apparent concentration of muscular tissue in any particular portion and the nerves present are not restricted to any one part.

In conclusion the writer would like to thank all who have helped in this work. In particular, thanks are due to Dr. F. H. Drummond under whose direction this work was carried out, Mr. A. G. Willis for help with the histology, Dr. A. M. Clarke for help with the paper partition chromatography, Miss J. H. Macpherson for making available the shell collections of the National Museum of Victoria, Dr. D. MacMichael for making available the type *Katelysia enigma* held in the Australian Museum, Sydney, Mr. B. C. Cotton for making available specimens from the collection of the South Australian Museum, Dr. E. Binder for photographs of types held in the Musee d'histoire Naturelle, Geneva, Mr. E. L. Wilkins for comments on specimens in the British Museum, figured by Reeve in his Conchologia Iconica and Miss I. Bennett of University of Sydney.

BIBLIOGRAPHY.

Allan, J., 1950.—Australian Sea Shells (Georgian House, Melbourne).

Atkins, D., 1936.—On the ciliary mechanisms and inter-relationships of lamellibranchs—I. Some new observations on sorting mechanisms in certain lamellibranchs. (Quart. J. Micro. Sci., Vol. 79, p. 181–308.)

Atkins, D., 1937A.—On the ciliary mechanisms and inter-relationships of lamellibranchs—II. Sorting devices on the gills. (Quart, J. Micro. Sci., Vol. 79, p. 339–373.)

Atkins, D., 1937B.—On the ciliary mechanisms and inter-relationships of lamellibranchs—III. Types of lamellibranch gills and their food currents. (Quart. J. Micro. Sci., Vol. 79, p. 375–421.)

Atkins, D., 1938.—On the ciliary mechanisms and inter-relationships of lamellibranchs—VII. Latero-frontal cilia of the gill filaments and their phylogenetic value. (Quart. J. Micro. Sci., Vol. 80, p. 345–436.)

Atkins, D., 1943.—On the ciliary mechanisms and inter-relationships of lamellibranchs—VIII. Notes on the gill musculature in Microciliobranchia. (Quart. J. Micro. Sci., Vol. 84, p. 187–256.)

Awati, P. R., and Rai, H. S.—*Ostrea cucullata* (the Bombay Oyster). (Indian Zool. Memoir, No. 3, Lucknow.)

Black, R. J., Lestrange, R., and Zweig, G., 1952.—Paper Chromatography: A Laboratory Manual. (Academic Press Inc., New York.)

Buzzati-Traverso, A. A., 1953.—Identification of recessive gene heterozygotes, by means of paper partition chromatography. (Nature, Lond., Vol. 171, p. 575.)

Buzzati-Traverso, A. A., and Rechnitzer, A. B., 1953.—Paper partition chromatography in taxonomic studies. (Science, Vol. 117, p. 58.)

Cerriotti, G., 1956.—A simple paper chromatographic technique for the study of free metabolites of tissues and body fluids. (Nature, Vol. 175, p. 897.)

Chemnitz, 1784.—Conchylien Cabinet (Volume VII.).

Coe, W. R., 1943.—Sexual differentiation in mollusks: I. Pelecypods. (Quart. Rev. Biol., Vol. 18, No. 2, p. 154–164.)

Coe, W. R. 1944.—Sexual differentiation in molluscs: II. Gastropods, Amphineurans, Scaphopods and Cephalopods. (Quart. Rev. Biol., Vol. 19, No. 2, p. 85–97.)

Cotton, B. C., and Godfrey, F. K., 1938.—The Mollusca of South Australia; Part I. Pelecypoda; Part II. Loricata and Cephalopoda. (Govt. Printer, Adelaide.)

Crocker, R., and Cotton, B. C., 1946.—Some raised beaches of the lower south-east of South Australia and their significance. (Trans. roy. Soc. Sth. Aust., Vol. 70, (1), p. 64.)

Dakin, W. J., 1928.—The anatomy and phylogeny of *Spondylus* with a particular reference to the lamellibranch nervous system. (Proc. roy. Soc. Lond., Ser. B., Vol. 103, p. 337–354.)

Dall, W. H., 1902.—Synopsis of the Carditacea and of the American species. (Proc. Ac. Nat. Sci. Phil., Vol. 54, p. 696–716.)

Delessert, B., 1841.—Recueil des Coquilles décrites par Lamarck dans son Histoire naturelle des animaux sans vertèbres et non encore figurée. (Paris.)

Deshayes, G. P., 1853.—Catalogue of the Conchifera or Bivalve Shells in the collection of the British Museum: Part I. *Veneridae, Cyprinidae* and *Glauconomidae.*

Donovan, E., (1823), 1834.—Naturalist's Repository, Volume 3.

Edmondson, C. H., 1920.—The reformation of the crystalline style in *Mya arenaria.* (J. Exp. Zool., Vol. 30, p. 259–291.)

Endicott, K. M., and Lillie, R. D., 1944.—Ceroid and the pigment of dietary cirrhosis in rats, its characteristics and its differentiation from hemofuchsin. (Amer. J. Path., Vol. 20, p. 149.)

Fisher, L. R., Kon, S. K., and Thompson, S. Y., 1956A.—Vitamin A and carotenoids in certain invertebrates. IV. Mollusca: Loricata, Lamellibranchiata and Gastropoda. (J. Mar. Biol. Ass. U.K., Vol. 35, p. 41–61.)

Fisher, L. R., Kon, S. K., and Thompson, S. Y., 1956B.—Vitamin A and carotenoids in certain invertebrates. V. Mollusca: Cephalopoda. (J. Mar. Biol. Ass. U.K., Vol. 35, p. 63–80.)

Forster, J., 1914.—Über die Leuchtorgane und das Nervensystem von *Pholas dactylus.* (Zeitschr. f. wiss. Zool., Vol. 109, p. 349–392.)

Gmelin, 1791.—System Naturae, edition 13.

Grobben, C., 1887.—Die Pericardial Drüse der Lamellibranchiaten. (Arb. aus Zool. Inst. Wien., Vol. 7, p. 355.)

Gutheil, F., 1912.—Über den Darmkanal und die Mitteldarmdrüse von *Anodonta cellensis* Schrot. (Zeitschr. f. wiss. Zool., Vol. 99, III., p. 444.)

Haas, F., 1935.—Bivalvia (Bronn's Klassen und Ordungen des Tier-Reichs, Band III., Mollusca.)

Hadorn, E., and Mitchell, H. K., 1951.—Properties of mutants of *Drosophila melanogaster* and changes during development as revealed by paper chromatography. (Proc. Nat. Acad. Sci. U.S.A., Vol. 37, p. 650.)

Hale, H. M., 1927.—Crustaceans of South Australia. Part I. (Govt. Printer, Adelaide.)

Hanley, S., 1842–1856.—An illustrated and descriptive Catalogue of Recent Bivalve Shells with 960 figures by Wood and Sowerby forming an appendix to the Index Testaceologicus. (Williams and Norgate, London.)

Hedley, C., 1917.—Checklist of the Marine Mollusca of New South Wales. (Proc. roy. Soc. N.S.W., Vol. 50, p. M.1.)

Hirase, S., 1954.—An illustrated handbook of shells in natural colours from the Japanese Islands and adjacent territory; revised and enlarged by Isao Taki. (Maruzen, Tokyo.)

Iredale, T., 1936.—Australian Molluscan Notes No. 2. (Rec. Aust. Mus., Vol. 19, p. 278.)

Jukes-Brown, A. J., 1914.—A synopsis of the family Veneridae, part 2. (Proc. Mal. Soc. Lond., Vol. 11, pt. 11, p. 75–94.)

Kershaw, R. C., 1955.—Systematic List of the Mollusca of Tasmania. (Proc. roy. Soc. Tas., Vol. 89, p. 287.)

Kira, T., 1959.—Coloured illustrations of the shells of Japan. (Hoikusha, Osaka.)

Kirk, R. L., Main, A. R., and Beyer, F. G., 1954.—The use of paper partition chromatography for taxonomic studies in landsnails. (Biochem. Journ., Vol. 57, No. 3, p. 440–442.)

Lamarck, J. B. P. A. de, 1818.—Histoire naturelle des animaux sans Vertèbres.

Lamarck, J. B. P. A. de, 1819.—Ibid. ed. G. P. Deshayes.

Lamarck, J. B. P. A. de, 1839.—Ibid. ed. G. P. Deshayes and H. Milne Edwards.

Lamy, Ed., 1935.—Sur le *Venus corrugata* Lamarck (Moll. Lamellibr.). (Bull. du Mus. Nat. d'Hist. Natur. Paris, Ser. 2, T. 7, No. 6, p. 357.)

Lamy, Ed., 1937.—Notes sur les espèces Lamarckiennes de *Katelysia* (Moll. Lamellibr.). (Bull. du Mus. Nat. d'Hist. Natur. Paris, Ser. 2, T. 9, No. 1, p. 73.)

Lillies, R. D., Daft, F. S., and Sebrell, W. H., 1941.—Cirrhosis of liver in rats on a deficient diet and the effect of alcohol. (U.S. Pub. Health Rep., Vol. 56, p. 1255.)

Lillie, R. D., Ashburn, L. L., Sebrell, W. H., Daft, F. S., and Lowry, J. V., 1942.—Histogenesis and repair of the hepatic cirrhosis in rats, produced on low protein diet and preventable with choline. (U.S. Pub. Health Rep., Vol. 57, p. 502.)

Loosanoff, V. L., 1937.—Development of the primary gonad and sexual phases in *Venus mercenaria* Linnaeus. (Biol. Bull., Vol. 72, p. 389–405.)

Loosanoff, V. L., 1942.—Seasonal gonadal changes in the adult oysters *Ostrea virginica* of Long Island Sound. (Biol. Bull., Vol. 82, p. 195–206.)

Macginitie, G. E., 1941.—On the method of feeding of four pelecypods. (Biol. Bull., Vol. 80, p. 18–25.)

Macginitie, G. E., 1945.—The size of the mesh openings in mucous feeding nets of marine animals (Biol. Bull., Vol. 88, p. 107–111.)

MacMunn, C.A., 1900.—On the gastric gland of mollusca and decapod crustacea: its functions. (Phil. Trans. roy. Soc. Lond., Ser. B., Vol. 193, p. 1–34.)

Macpherson, J. H., 1958.—Illustrated Index of Tasmanian Shells by W. L. May (revised). (Govt. Printer, Hobart.)

Macpherson, J. H., and Chapple, E. H., 1951.—A systematic list of the Marine and Estuarine Mollusca of Victoria. (Mem. nat. Mus. Vic., Vol. 17, p. 107.)

Macpherson, J. H., and Gabriel, C. J., 1962.—Marine Mollusca of Victoria. (Melb. Univ. Press in assoc. with Nat. Mus. Vic.)

Marwick, J., 1927.—The Veneridae of New Zealand. (Trans. and Proc. New Zealand Institute, Vol. 57, p. 567.)

Matthais, M., 1914.—Untersuchung über den Darmkanal und das Herz einiger Arcaceen. (Jen. Zeitschr. f. Natur., Vol. 52, p. 363–444.)

May, W. L., 1921.—A Check List of the Mollusca of Tasmania. (Govt. Printer, Hobart.)

May, W. L., 1923.—Illustrated Index of Tasmanian Shells. (Govt. Printer, Hobart.)

Mayr, E., Lindsley, E. B. and Usinger, R. L., 1953.—Methods and Principles of Systematic Zoology. (McGraw-Hill, New York.)

Menke, C. L., 1843.—Molluscorum Novae Hollandiae, (Hannoverae).

Metschnikoff, E., 1884.–Researches on the intracellular digestion of invertebrates. (Quart. J. Micro. Sci., Vol. 24, p. 89.)

Nelson, T. C., 1918.—On the origin, nature and function of the crystalline style of lamellibranchs. (Journ. Morph., Vol. 31, pt. 1, p. 53.)

Orton, J. H., Southward, A. J., and Dodd, J. M., 1956.—Studies on the biology of limpets—11. The breeding of *Patella vulgata* L. in Britain. (J. Mar. Biol. Ass. U.K., Vol. 35, p. 149–176.)

Pelseneer, P., 1891.—Contribution à l'étude des Lamellibranches. (Arch. Biol., Vol. 2, p. 147–312.)

Philippi, R. A., 1849.—Abbildungen und Beschreibungen neuer oder wenig gekannter Concholien unter Mithülfe mehrerer deutscher Concholiologien (Cassel).

Pritchard, G. B., and Gatliff, J. H., 1903.—Observations on our commonest species of *Chione*. (Proc. roy. Soc. Vic., Vol. 16 (n.s.), pt. 1, p. 94, pl. 15.)

Pritchard, G. B., and Gatliff, J. H., 1903.—Catalogue of the Marine Shells of Victoria pt. 7. (Proc. roy. Soc. Vic., Vol. 16 (n.s.), pt. 1, p. 96.)

Reeve, L. A., 1864.—Conchologica Iconica.

Ridewood, W. G., 1903.—The structure of the gills of the Lamellibranchia. (Phil. Trans. roy. Soc. Lond., Ser. B., Vol. 195, p. 147.)

Römer, Ed., 1857.—Kritische Untersuchung der Arten der Molluschengeschlechts Venus bei Linne und Gmelin mit Berucksichtigung der später beschriebenen Arten (Cassel).

Schenk, E. T., and McMasters, J. H., 1950.—Procedure in Taxonomy (Stanford, California).

Schwanecke, G., 1913.—Das Blutgefaßsystem von *Anodonta cellensis* Schmidt. (Zeitschr., f. wiss. Zool., Vol. 108, p. 1–77.)

Sowerby, G. B., 1849–1855.—Thesaurua Conchyliorium (Vol. 2).

Stempell, W., 1912.—Über das sogenannte sympathische Nervensystem der Muscheln. (Festschr., med. nat. Ges. Munster, p. 222–234.)

Tate, R., and May, W. L., 1901.—A revised Census of the Marine Mollusca of Tasmania. (Proc. Linn. Soc. N.S.W., pt. 3, p. 344.)

Tenison-Woods, J. E., 1878A.—Census with brief descriptions of Marine Shells of Tasmania and the adjacent islands. (Proc. roy. Soc. Tas. for 1877.)

Tenison-Woods, J. E., 1878B.—On some new marine mollusca. (Trans. and Proc. roy. Soc. Vic., Vol. 14, p. 55.)

Thiele, J., 1935.—Handbuch der Systematischen Weichtierkunde (Jena, Verlag von Gustav Fischer).

White, K. M., 1928.—The pericardial cavity and pericardial gland of the lamellibranchs. (Proc. Mal. Soc. Lond., Vol. 25, pt. 2, p. 37.)

Yonge, C. M., 1926A.—The digestive diverticulae in the lamellibranchs. (Trans. Roy. Soc. Edin., Vol. 54, p. 703.)

Yonge, C. M., 1926B.—Structure and physiology of the organs of feeding and digestion in *Ostrea edulis*. (J. Mar. Biol. of Ass., Vol. 14, p. 295–386.)

Yonge, C. M., 1927.—Structure and function of the organs of feeding and digestion in the septibranchs *Cuspidaria* and *Poromya*. (Phil. Trans. Roy. Soc. Lond., Vol. 216, p. 221–263.)

Yonge, C. M., 1948.—Formation of siphons in Lamellibranchia. (Nature, Vol. 161, p. 198.)

Zachs, G. I., 1955.—The cytochemistry of the amoebocytes and intestinal epithelium of *Venus mercenaria* (Lamellibranchiata) with remarks on a pigment resembling ceroid. (Quart. J. Micro. Sci., Vol. 96, pt. 1, p. 57.)

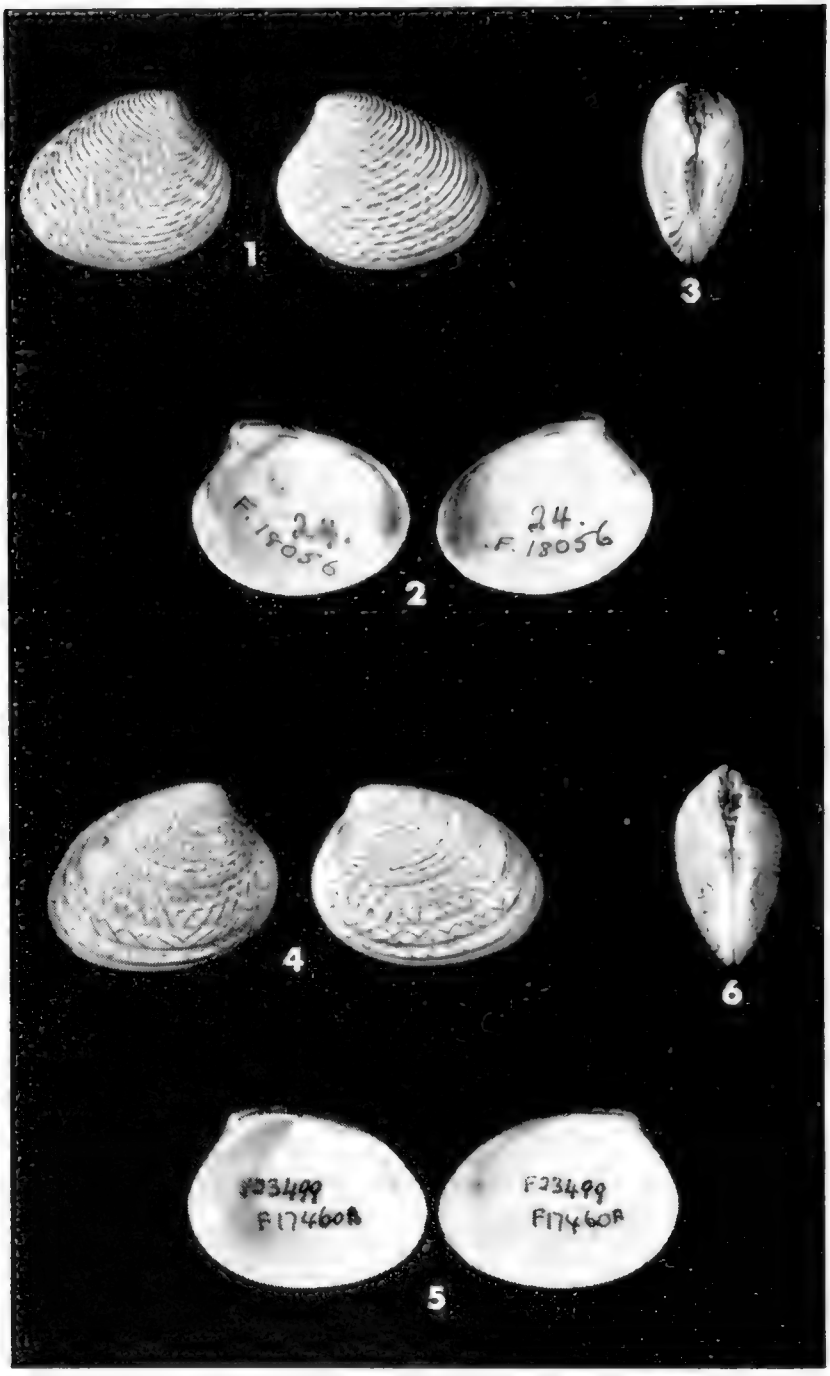


PLATE I.

Katelysia scalarina (Lamarck).

1. Exterior of valves; 2. Interior of valves; 3. Dorsal view showing umbos, ligamental area and lunule.

Katelysia scalarina variety *polita* sp. n.

4. Exterior of valves of holotype; 5. Interior of valves of holotype; 6. Dorsal view showing umbos, ligamental area and lunule.

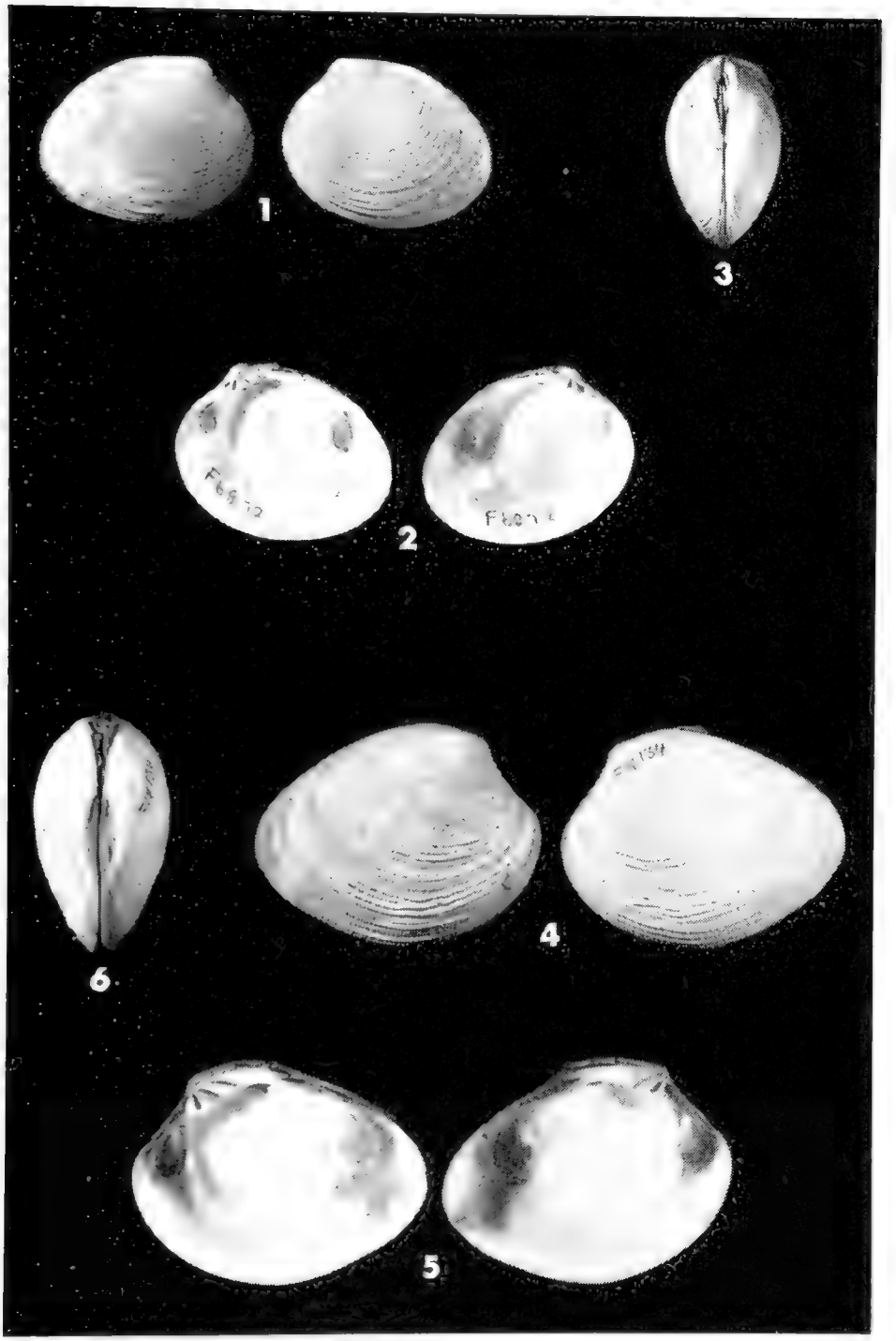


PLATE II.

Katelysia peroni (Lamarck).

1. Exterior of valves; 2. Interior of valves; 3. Dorsal view showing umbos, ligamental area and lunule.

Katelysia rhytiphora Lamy.

4. Exterior of valves; 5. Interior of valves; 6. Dorsal view showing umbos, ligamental area and lunule.

FIRST AUSTRALIAN RECORD *HEXANCHUS GRISEUS* (BONNATERRE) 1780. THE SIX-GILLED SHARK

By D. D. Lynch, Chief of Division of Marine Fisheries, Fisheries and Wildlife Department of Victoria.

INTRODUCTION.

On 29th March, 1963, Mr. B. Newman, a professional fisherman operating in 110 fathoms off Port Fairy, Victoria, caught a shark with six gill slits and one dorsal fin, weighing 48·635 kg. (107 lb.) and 218·7 cm. (7 ft. 2 in.) in length.

Recognizing the specimen as unusual, Mr. F. B. O'Brien, Fisheries and Wildlife Officer for the district, secured the specimen for further examination.

The shark was later identified as a male six-gilled shark, *Hexanchus griseus* (Bonnaterre) 1780, Order Hexanchiformes, Family Hexanchidae.

The specimen is lodged in The National Museum, Melbourne, Nat. Mus. Reg. No. A.235.

The species has not been recorded in Australian waters previously although two other members of the family occur here: *Heptranchias dakini* (Whitley) 1931, the One-finned shark, and *Notorhynchus cepedianus* (Peron) 1807, the Seven-gilled shark. Both these species have seven gill slits and by this character may be readily distinguished from *Hexanchus griseus*.

DESCRIPTION.

A detailed description of the six-gilled shark and a list of the relevant literature is given by Bigelow and Schroeder (1948), and the specimen from Victoria agrees with the description given by these authors.

It was uniformly coffee-coloured, except for a white patch near the pectoral fins, with the ventral surface darker than in the specimen described by Bigelow and Schroeder. However, as the pigment came off the body readily, this difference is considered to be of minor importance.

MEASUREMENTS.

The method of measurement follows that used by Bigelow and Schroeder—

Weight: 48·635 kg.

Total length: 218·7 cm.

Trunk at origin of pectoral: breadth .. 31·8 cm.;
height .. 24·5 cm.

Snout length in front of outer nostrils .. 4·2 cm.;
mouth .. 10·1 cm.

Eye: horizontal diameter: 5·2 cm.

Mouth: breadth: 23·2 cm.

Nostrils: distance between inner ends: 10·9 cm.

Gill opening lengths: 1st 25·0 cm.; 2nd 21·5 cm.;
3rd 21·1 cm.; 4th 20·5 cm.;
5th 15·2 cm.; 6th 13·1 cm.

First dorsal fin: vertical height 9·7 cm.; length of base 16·3 cm.

Anal fin: vertical height 7·8 cm.; length of base 11·6 cm.

Caudal fin: upper margin 69·0 cm.; lower anterior margin 17·6 cm.

Pectoral fin: outer margin 28·5 cm.;
upper margin 11·0 cm.;
distal margin 22·0 cm.

Distance from snout to: 1st dorsal 120·2 cm.;
upper caudal 155·0 cm.;
pectorals .. 39·8 cm.;
pelvics .. 107·6 cm.;
anal .. 138·8 cm.

Interspace between: 1st dorsal and caudal 20·0 cm.;
anal and caudal .. 10·9 cm.

Distance from origin to origin of:
pectorals and pelvics .. 77·0 cm.;
pelvics and anal .. 31·5 cm.

An internal examination of the specimen was not made.

GEOGRAPHICAL DISTRIBUTION.

Bigelow and Schroeder (*loc. cit.*) list the range of *Hexanchus griseus* as: the eastern and western Atlantic, the Mediterranean, the Pacific coasts of North and South America, Japan, Australia, the Southern Indian Ocean and South Africa.

The shark is reported to live in waters from 437–1,025 fm. off Portugal, over 100 fm. off Ireland, 90–500 fm. off Scotland, and 75–300 fm. off Cuba.

It was first recorded from New Zealand waters by Phillipps (1946), who described two specimens taken in Cook Strait. Since that date, Parrott (1958) has reported additional captures by trawl gear from deeper water.

Evidently, Bigelow and Schroeder based the Australian range on Phillipps' record from New Zealand, as neither Whitley (1940) nor Munro (1956) lists it as occurring in Australian waters.

SIZE RANGE.

Bigelow and Schroeder (*loc. cit.*) estimated the size of the six-gilled shark at birth as from 400 to 500 mm., with maturity expected at about 182 cm. The recorded lengths of the larger specimens range up to 4·82 m. (15½ ft.) with one doubtful record from Cornwall of 26 ft. 5 in.

ACKNOWLEDGMENTS.

The author desires to thank Mr. F. B. O'Brien for procuring the specimen from Mr. B. Newman, who kindly donated it for examination; Miss C. F. Crellin for preparing the drawings and Mr. G. P. Whitley of the Australian Museum, Sydney, who suggested useful references.

REFERENCES.

Bigelow, H. B. and Schroeder, W. C. (1948).—Fishes of the Western North Atlantic. Pt. 1. Lancelets, cyclostomes and sharks. Yale Univ., Sears Foundation Mar. Res., Mem. 1, pp. 80–87.

Munro, I. S. R. (1956.—Handbook of Australian Fishes. Fish. Newsletter Aust. 15 (7).

Parrott, A. W. (1958).—Big Game Fishes and Sharks of New Zealand, pp. 83–4. Hodder and Stoughton Ltd., London.

Phillipps, W. J. (1946).—Sharks of New Zealand. Dom. Mus. Rec. Zool. 1 (2): pp. 1–20.

Whitley, G. P. (1940).—The Fishes of Australia. Pt. 1. The Sharks, Rays, Devil-Fish, and other Primitive Fishes of Australia and New Zealand. Royal Zoological Society of New South Wales, Sydney.

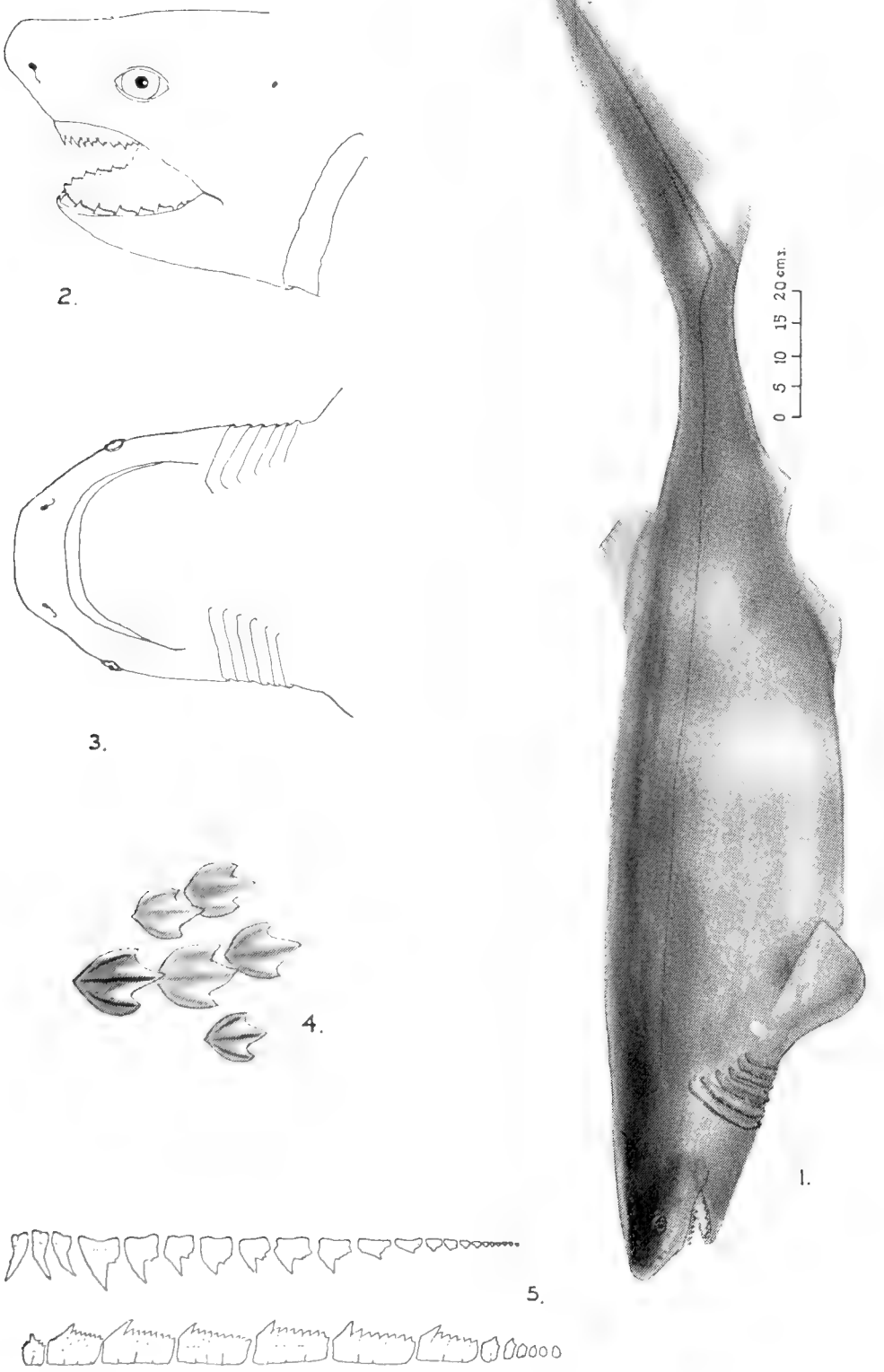


PLATE 1.

Fig. 1. Lateral view of *Hexanchus griseus* (Bonnaterre), the Six-gilled shark.
Fig. 2. Enlarged lateral view of head.
Fig. 3. Ventral view of head to show arrangement of gill slits.
Fig. 4. Denticles of six-gilled shark, magnified × 40 (after Bigelow and Schroeder).
Fig. 5. Upper and lower dentition (after Bigelow and Schroeder).

BY AUTHORITY:
A. C. BROOKS
GOVT. PRINTER. MELBOURNE